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Practical & Theoretical Mechanics & Chemistry.

Report of the Committee of the Franklin Institute of Pennsylvania for the Promotion of the Mechanic Arts, appointed to ascertain, by experiment, the Value of Water as a Moving Power.

[CONTINUED FROM PAGE 224.]

7. *Comparison of the effects of high and low overshot wheels.*—The Committee next proceed to compare the deductions made for the overshot wheel No. I, with the results for Nos. II, III, and IV. The following table presents the ratio of effect to power in wheel No. II, fifteen feet in diameter.

TABLE EIGHTEENTH.

Showing the ratio of effect to power with overshot wheel No. II. Taken from table a. (Vol. ix, 2nd series, p. 298.)

Table.	Head above gate. Feet.	Head and fall. Feet.	Width of aperture. Feet.	Ratio of effect to power.	Mean ratio.	Table.	Head above gate. Feet.	Head and fall. Feet.	Width of aperture. Feet.	Ratio of effect to power.	Mean ratio.
a I.	5.50	20.50	1.00	.746	.746	a II.	1.50	16.50	1.75	.841	.840
"	3.00	18.00	1.00	.801		"	1.00	16.00	1.75	.855	.855
"	"	"	1.50	.818	.809	"	0.84	15.84	"	.830	.830
a II.	1.50	16.50	1.50	.840		"	0.75	15.75	"	.841	.841
				Mean	.777					Mean	.841

The average ratio with the low heads is the same as with wheel No. I. *Eighty-four per cent. of the power expended may, as before, be relied on for the effect.*

The falling off of the ratios at heads bearing a considerable proportion to the fall, is also distinctly seen, although the coefficients are not entirely regular in their increase.

We have now a satisfactory test to apply in ascertaining whether

the effect of an overshot wheel under different heads of water above the gate may be calculated by supposing the effect made up of the impulse from the water striking the buckets and of the gravity of the water in the subsequent descent.

As in the case before calculated, (pp. 323–4) the water is accelerated after leaving the aperture, and a virtual head corresponding to the distance from the bottom of the gate to the bottom of the bucket is to be found.* This, added to the head above the gate, is the head of impulse to which the undershot coefficient is to be applied.

The head above the bottom of the bucket, taken from the head and fall gives the height to which the theoretical overshot coefficient is to be applied. The sum of the products thus found, divided by the head and fall gives a coefficient which should correspond with the ratio actually found, if the principles and details of the calculation are correct.

The data are specified in the table which follows, with the particulars of the calculation. In the last two columns a comparison is made between the numbers thus calculated and the ratios actually found in the foregoing table.

TABLE NINETEENTH.

Comparison of the calculated with the observed ratios of effect to power, in overshot No. II.

Head above gate.	Effective head of impulse.	Product of effective head by undershot coefficient.	Product of fall, from bottom of bucket to bottom of wheel by overshot coefficient	Sum of product of effective fall by overshot coefficient and head by undershot.	Head and fall.	Calculated ratio of effect to power.	Ratio of effect to power by experiment.	Difference
Feet.	Feet.				Feet.			
5.50	7.12	2.02	12.73†	14.75	20.50	.720	.746	—.026
3.00	4.62	1.31	"	14.04	18.00	.780	.809	—.021
1.50	3.12	0.89	"	13.62	16.50	.826	.840	—.014
1.00	2.62	0.74	"	13.47	16.00	.843	.855	—.012
0.84	2.46	0.70	"	13.43	15.84	.848	.830	+.018
0.75	2.37	0.67	"	13.40	15.75	.851	.841	+.010
							Sum of errors	—.045
							Mean	—.007

* Gate *c* was used in these experiments. Whether the actual velocity of the efflux is increased by this gate or not, its effects are calculable upon such a supposition; we have, therefore, adopted $(.72)^2$ as a divisor in deducting the effective head corresponding to the distance between the bottom of the gate and the bottom of the bucket (.85 ft.)

† The fall is 14.15 ft., and the overshot coefficient is taken at .9 to facilitate the calculations.

The greatest difference between calculation and experiment being less than three per cent., the result may be considered as entirely satisfactory. The average error is but one per cent.

The accordance of the effects obtained from wheels Nos. I and II is thus shown to be complete, the effect of the increased proportion which the part where the water begins to escape from the wheel to the effective fall being, however, perceptible.

In the following table the results of experiments with wheels Nos. III and IV, are combined. The first was ten and the second six feet in diameter.

The form of gate by which water was admitted to the wheel having been changed,* the effective impulse for a given head above the gate is somewhat varied, but as the effect of this correction would merely be perceived in the cases of the higher heads, and as these differ but little more from the results of calculation, than the low ones, it has been thought better not to make any correction on this account.

TABLE TWENTIETH.

Comparison of the calculated with the observed ratios of effect to power, overshot wheels Nos. III and IV.

Head above gate.	Effective head of impulse.	Product of effective head by undershot coefficient.†	Product of fall from bottom of bucket to bottom of wheel by overshot coefficient	Sum of last two named products.	Head and fall.	Calculated ratio of effect to power.	Experimental ratio of effect to power.	Difference
Feet.	Feet.				Feet.			
0.25	1.87	0.52	8.46	8.98	10.5	.855	.817	+.038
0.75	2.37	0.66	"	9.12	11.0	.829	.809	+.020
1.75	3.37	0.94	"	9.40	12.0	.783	.758	+.025
2.75	4.37	1.22	"	9.68	13.0	.745	.710	+.035
3.75	5.37	1.50	"	9.96	14.0	.711	.670	+.041
							Mean difference	+.032

* For this gate, c, plate vii., Jour. Frank. Inst. vol. x., the ratios of the actual to the theoretical discharge per second, is : .62 : 1.

† Assumed at .28.

Comparison of the calculated with the observed ratios of effect to power, overshot wheel No. IV.

Head above gate.	Effective head of impulse.	Product of effective head by undershot coefficient	Product of fall from bottom of bucket to bottom of wheel by overshot coefficient	Sum of last two named products.	Head and fall.	Calculated ratio of effect to power.	Experimental ratio of effect to power.	Difference
Feet.	Feet.				Feet.			
0.25	1.68	0.47	4.95	5.42	6.5	.834	.810	+.024
0.75	2.18	0.61	"	5.56	7.0	.794	.793	+.001
2.75	4.18	1.17	"	6.13	9.0	.680	.645	+.035
3.75	5.18	1.45	"	6.40	10.0	.640	.604	+.036
							Mean difference	+.024

The calculated ratios exceed the observed ones less than three per cent. at a mean. The effect of wheel No. IV, appears rather better than that of No. III, perhaps, in part, from its having been raised so that the top was nearer to the gate.

It follows from these experiments that *low overshot wheels may be used to nearly the same advantage as high ones*, the diminution of effect when the wheels are duly arranged, amounting to but about three per cent., in a comparison between a wheel of twenty feet and one of six feet diameter. The conclusion on page 149, in reference to question 1, is thus shown to be applicable to low as well as high overshot wheels. As this is an important conclusion, the Committee will again consider the proofs afforded of it by the experiments.

The introduction of the virtual head of impulse in these calculations, while it is certainly more accurate in a theoretical point of view, tends to render the calculations more difficult in practice. A mode of calculating the effective power of an overshot wheel when the head and fall of water and the dimensions of the wheel are given, is desirable for practice; hence the following table has been compiled to show that, practically, the head above the bottom of the bucket may be used with the undershot coefficient, in calculating the effect of impulse, the fall below the bottom of the bucket being taken as the factor for the overshot coefficient. In fact, the less rigid mode of calculation produces results, on the average, more nearly in accordance with experiment than the other mode.

TABLE TWENTY-FIRST.

Comparison of the ratio of effect to power in overshot wheels under different heads, as calculated upon the head above, and fall below, the bottom of the bucket, with the ratio found by experiment.

Head above bottom of bucket.	Product of head above bottom of bucket by .28.	Product of fall below bottom of bucket by .9, added to preceding product.	Head and fall.	Calculated ratio of effect to power.	Observed ratio of effect to power.	Difference.
			Overshot wheel No. I.			
3.60	1.01	18.47	23.00	.800	.828	—.028
2.10	0.59	18.05	21.50	.839	.842	—.003
1.35	0.38	17.84	20.75	.860	.845	+.015
					Mean	—.005
			Overshot wheel No II.			
6.35	1.78	14.51	20.50	.708	.746	—.038
3.85	1.08	13.81	18.00	.767	.809	—.042
2.35	0.66	13.39	16.50	.811	.840	—.029
1.85	0.50	13.23	16.00	.826	.855	—.029
1.69	0.47	13.20	15.84	.833	.830	+.003
1.60	0.45	13.18	15.75	.836	.841	—.005
					Mean	—.023
			Overshot wheel No. III.			
1.10	0.31	8.77	10.50	.835	.817	+.018
1.60	0.45	8.91	11.00	.810	.809	+.001
2.60	0.73	9.19	12.00	.796	.758	+.038
3.60	1.01	9.47	13.00	.728	.710	+.018
4.60	1.29	9.75	14.00	.696	.670	+.026
					Mean	+.020
			Overshot wheel No. IV.			
1.00	0.28	5.23	6.50	.805	.810	—.005
1.50	0.42	5.37	7.00	.767	.793	—.026
3.50	0.98	5.93	9.00	.660	.645	+.015
4.50	1.26	6.21	10.00	.621	.604	+.017
					Mean	—.000
					General average of the differences for the four wheels	+.002

The sums of the positive and negative errors in this calculation more nearly balance each other than in the former. A very easy practical rule is thence deducible for calculating the effective power of an overshot wheel.

If the ratio of effect to power in a theoretical overshot wheel, or one where allowance is made for loss by the head of water above the top of the wheel, as deduced from the high and low wheels, is the same as we have already found it to be, it follows, as before stated, that low wheels are as effective in practice as high ones, in proportion to the head and fall of water. To exhibit this by reference to the experiments themselves, and without additional calculations, the following table has been prepared. Part first contains a selection from tables sixth, (p. 149,) nineteenth, (p. 290,) and twentieth, (p. 291,) of those heads above the gate, which have a less ratio to the head and fall, than about one to six or seven. Under the separate designations of the wheels, are given the heads above the gate, the head and fall, the ratio of the head above the gate to the head and fall, and the observed ratio of effect to power. Part second of this table contains the same data differently arranged, namely, according to the order of the ratios of each head to the head and fall. The three columns of this second part contain the ratio just referred to, the designation of the wheel, and the ratio of effect to power, as found by experiment.

TABLE TWENTY-SECOND.

Part First.
Showing the ratio of effect to power with different overshot wheels, under different heads, bearing a small proportion to the head and fall.

Head above gate.	Head and fall.	Proportion of head to head and fall.	Ratio of effect to power.
Overshot wheel No. I.			
0.50	20.75	.024	.845
1.25	21.50	.058	.842
2.75	23.00	.120	.828
	Mean	.067	.838
Overshot wheel No. III.			
0.25	10.50	.024	.817
0.75	11.00	.068	.809
1.75	12.00	.146	.758
	Mean	.079	.795
Overshot wheel No. II.			
0.75	15.75	.048	.841
0.84	15.84	.053	.830
1.00	16.00	.062	.855
1.50	16.50	.091	.840
	Mean	.063	.841
Overshot wheel No. IV.			
0.25	6.50	.038	.810
0.75	7.00	.107	.793
	Mean	.072	.801

Part Second.
Containing the same data as part first, arranged in the order of the proportion of head, to head and fall.

Proportion of head to head and fall	Number of wheels.	Ratio of effect to power.
.024	No. I.	.845
"	" III.	.817
.038	" IV.	.810
.048	" II.	.841
.053	" II.	.830
.058	" I.	.842
.062	" II.	.855
.068	" III.	.809
.091	" II.	.840
.107	" IV.	.795
.120	" I.	.828
.146	" III	.758

The mean ratios deduced from part first of the foregoing table, if arranged in the order of the proportion of head to head and fall, would stand thus:

Wheel No. II.	Proportion of head to head and fall,			.063.	Ratio of effect to power,		.841
I.	"	"	"	.067.	"	"	.838
IV.	"	"	"	.072.	"	"	.801
III.	"	"	"	.079.	"	"	.795

The increasing series of proportion of head and fall has corresponding to it a decreasing series of ratios of effect to power, in which wheel No. II, of fifteen feet in diameter, has a higher ratio than No. I, of twenty feet, and No. IV, of six feet, a higher ratio than No. III, of ten feet. The increase in the mean proportion of head to head and fall, between the first and last average, just given, is much greater than the decrease of ratio in the same cases. Taking the average of all the ratios of effect to power, given in part second of the last table, it appears that in calculating the effect of an overshot wheel, even as small as six feet in diameter, *eighty-three per cent. of the power may be taken for the effect*, provided the head above the gate does not exceed one-eighth of the head and fall, and the wheel is running so as to give the maximum ratio of effect to power.

The second deduction in regard to the overshot wheel, had reference to the ratio of the velocity of the wheel to that of the water striking it (page 150.) The following table gives a similar comparison for wheel No. II.

The velocity of efflux, of the water having been calculated, as explained on page 150, the virtual head corresponding to it, is obtained according to the principles laid down in page 153. To this is added the distance from the bottom of the gate to the bottom of the bucket, and the velocity of the impinging water, is calculated from this head.

In the table, the head above the gate, the whole effective head of impulse, the velocity of the water, the velocity of the wheel, and the ratio, are arranged in successive columns.

TABLE TWENTY-THIRD.

Showing the relative velocity of the Water and Wheel. Overshot No. II.

Table whence taken.	Head above bottom of gate.	Effective head of impulse.	Velocity of water.	Velocity of wheel.	Ratio.
	Feet.	Feet.	Feet.	Feet.	
a. I.	5.50	2.99	13.87	7.45	.54
"	3.00	1.89	10.74	5.55	.52
"	"	1.83	10.83	6.44	.59
a. II.	1.50	1.16	8.58	5.44	.63
"	"	1.14	8.50	5.66	.66
"	1.00	0.90	7.60	4.35	.57
"	0.84	0.83	7.31	4.72	.64
"	0.75	0.77	7.02	3.41	.48
				Mean	.58

This coefficient will be seen to be nearly the same with those obtained with gates *b* and *c*, in wheel No. I. The conclusion drawn before, as to the constant ratio between the velocity of the wheel and of the water, is entirely confirmed. The evidence is the more important because the head is in this wheel varied from three quarters of a foot to five feet and a half. The two extremes of the table vary most from the law, which is in favour of its accuracy, since in the one case, the distance gone through after leaving the aperture, bears a very small proportion to the whole effective head, and in the other case, is nine-tenths of it.

The apertures having been but little varied in the case of this wheel, it does not admit of conclusions in regard to the effect of the quantity of water or the velocity of the wheel.

We are enabled to compare the effective velocity of the gate c, used in this wheel, and *a*, *b*, and *c*, used with No. I, and the effect will be found favourable to the three last, and against c. Thus it appears from table tenth, that the velocity of the water striking the buckets was under a head of 2.75 ft., 13.89 ft., and 11.65 feet, with the gates *b*, and *c*, respectively, while with *c*, from the table just given, under a three feet head, it was at a mean of but 10.78 ft., the fall after leaving the gate being the same in each case. In consequence of this, the velocities of this overshot wheel, do not, at a mean, come up to those of No. I, agreeing more nearly with the velocities given with gate *a*, than with the others.

There is nothing, however, in this to invalidate the conclusion above drawn, in regard to the relative velocity of the water and of the wheel.

It is plain that an increase of velocity must, in this wheel, produce a greater decrease of effect than in No. I, owing to the greater proportion which the head necessary to give the velocity required, will bear to the fall.

[TO BE CONTINUED.]

Technical Employment of Indigo. Part III. *By* J. C. Booth.

CONCLUDED FROM PAGE 231.

The indifferent character of indigo rendering it almost impossible to combine it with organic fibres, it is usual to submit it to one of two operations in order to effect its combination, either by reducing it to colourless indigo, or by solution in sulphuric acid, both of which processes were described in Part II. The modes of reduction vary according to the nature of the reducing material, for in the process referred to, it takes place in the cold, but where fermentation is resorted to, heat is usually applied.

1. *Copperas or common blue vat, cold vat.*—The principles of this process, as well as the mode of conducting it, were described in parts I and II, but the proportion of materials may vary according to their several qualities. Thus the following recipes are given among others.

Indigo,	1	1	1	6
Copperas,	2	3	4	15
Lime,	3	4	2	20
Potash,			2	4

The copperas should be as free as possible from peroxide of iron, which exerts no reducing influence, and from sulphate of copper, which would reoxidize the reduced blue colour. The lime is supposed to be in the dry hydrated state, that is, slaked with a quantity of water just sufficient to reduce it to a fine powder, and a due proportion of this hydrate should be employed, for an excess forms an insoluble compound with the reduced indigo occasioning an equal loss in the vat. This vat is adapted to silk, cotton, and linen, which are dipped into the yellow liquid after it has settled, suffered to remain in it a short time, taken out and exposed to the air, the oxygen of which acting on the reduced indigo, converts it into its characteristic blue shade. A weak bath and a single dipping may be sufficient for a light blue, but any desired shade may be attained by a more concentrated bath and more frequent dipping, observing to expose the fabric to the air after each dipping, until it receives its full depth of blue. After the last operation, the dyed materials are dried, treated with very dilute sulphuric or muriatic acid, to separate the lime, and finally rinsed in pure water. It appears then that the chief object to be attained by the reduction of indigo, is to render it soluble, so that it may enter into a fibrous texture, and then and there be converted into the blue by the operation of the air.

2. *Orpiment and tin vats.*—These are chiefly employed in printing goods, but their use depends on the same principles as those of the cold vat. For the former, one part finely powdered indigo, two parts potash, and 175 parts of water, are boiled; one part of freshly slacked lime is added, and the whole again boiled; and lastly, one part of orpiment (sulphuret of arsenic,) is added, and the mixture suffered to stand. It is usually thickened with gum, and applied by the hand or block. In this operation the arsenic and sulphur are oxidized at the expense of the indigo, which, in its reduced state, forms a soluble compound with the lime, while the generated acids of sulphur and arsenic combine with the potassa. The operation being tedious, and requiring much care in preparation, has given place to the frequent employment of oxide of tin instead of orpiment.

The following compositions are employed, the first for the block, and the second for cylinder printing.

Caustic soda lye,	=3½ galls.	3½ galls.
Hydrated protoxide of tin,	=5¼ lbs.	5 lbs.
Finely ground indigo,	=3½ lbs.	3½ lbs.
Raw sugar,	=21 lbs.	
Venice turpentine,		3 lbs.
Gum,		11 lbs.

The caustic lye should be of speci. grav. 1.15; the protoxide of tin is precipitated from a solution of protomuriate of tin by carbonate of potassa; the sugar and gum are used merely for thickening. The operation with the protoxide of tin depends on its affinity for oxygen, which converts it into the peroxide, while the indigo is simultaneously reduced and combines with soda. Turpentine is employed, in the second instance, in order to obviate the rapid reoxidation of indigo in the atmosphere; it being less necessary in the first case, since the mixture is kept more excluded from the atmospheric action. If a solution of muriate of tin be substituted for a portion of the precipitated protoxide, the mixture is less subject to oxygenation.

3. *Warm and fermented, or pastel, vat.*—Woad, indigo, madder, bran, potash, and lime, are employed, in this vat; the proportions of which necessarily vary; but the following may serve to show its usual composition; fifty woad, four indigo, three madder, two potash and caustic lime. The iron, copper, or wooden vat, is filled with water, and heated to 160° Fahrenheit, while the four ingredients are introduced; the temperature is maintained several hours, during which, slacked lime is gradually added, until one and one-third of caustic lime has been expended. The vat is now suffered to cool, during which, lime is again added in small portions. A fermentation ensues; the blue colour passes into green, and when the smell of acetic acid is perceptible, the liquid assumes a yellowish colour, and is ready for dyeing operations.

The theory of the process is analogous to that of the cold vat. The madder, woad, and bran, abounding in starch, sugar, gluten, &c., enter readily into fermentation in warm water, in order to maintain which, they abstract oxygen partly from the air, and in part from the indigo; the latter being thus reduced or deoxidized, forms a soluble combination with potassa, which is partially rendered caustic by lime. A portion of indigo-brown is dissolved with the blue, but is again precipitated by lime. Among other products of fermentation, carbonic and acetic acids are generated, which are neutralised by lime, and hence the gradual addition of this earth in proportion as they are produced. Woad simply dried, is better than the fermented

colouring material, for the latter is apt to become putrefied, an accident that sometimes happens, and may be remedied by more indigo and alkaline matter in the original proportion of ingredients. A quantity of lime should be added nearly sufficient to neutralise the generated acids, in order to keep the indigo in solution, and yet preserve a slight acidity in the bath, for if the fluid be alkaline it combines with the extractive matter, and forms an insoluble compound with indigo-blue, which is thus rendered inert. In a healthy state of the bath, therefore, lime has the property of rendering the potash more caustic and powerful, of precipitating indigo-brown, which would deteriorate the blue colour, of keeping the blue in solution, and of neutralising an excess of acidity.

4. *Urinous vat.*—This method of dyeing with indigo has been superseded in larger establishments by the preceding, and is now only practised on a small scale. Its operation depends on the fermentation of warm urine, by which the indigo is reduced, and combines with ammonia simultaneously generated.

5. *Potash vat.*—In this bath, indigo, madder, bran, and potash are employed, the last being added in several successive portions, while the bath is maintained at 122° Fahrenheit. The theory of the operation is similar to that of the pastel vat, excepting that only a small quantity of lime is added towards the close of the operation, to check fermentation, and precipitate indigo-brown. This vat is said to be superior to the pastel vat, although more expensive in materials, by requiring less time in dyeing, penetrating cloth better, by keeping sound for a longer time, and by requiring less outlay in its preparation.

6. *Sulphuric indigo vat.*—The theory of this solution was discussed in Part II. It is usually termed the Saxon blue dye, having been discovered by a Saxon of the name of Barth. As water prevents, more or less, the proper action of the acid, the fine indigo should be dried, and the sulphuric acid boiled, if it be not perfectly concentrated. One part of indigo is gradually added to six to eight parts of the acid, always taking care to prevent the mixture from becoming warm by keeping the vessel in cold water, where the temperature of the air is too high, for the action of the ingredients generates heat, and might destroy a portion of the blue colour. The mixture is suffered to stand thirty-six to forty-eight hours in a moderately warm place, which effects solution, and prevents the acid from attracting moisture. It may then be diluted with any desired quantity of water, and filtered, or drawn off clear. If goods be dyed in this solution, the red, brown, and glutinous matters of indigo are also attached to the material with the blue, which would therefore be deteriorated in its

beauty of shade. To avoid this, the indigo-blue (or ceruleo) sulphuric acid may be prepared by attaching it to wool, as described in Part II, washing with water, digesting in water containing a little carbonated alkali, and afterwards adding a little dilute sulphuric acid to the solution. By attaching it to the wool, gluten remains; by digestion with alkali, the indigo-red remains on the wool; and by the last addition of acid, indigo-brown is precipitated, while the alkali is supersaturated. The last clear solution communicates a fine blue colour to wool.

Probably the best method of preparing a fine blue is to add to the sulphuric solution of indigo about twenty times its volume of water, and add potash until one-fourth or one-third of the alkali is saturated. The ceruleo-sulphate of potassa precipitates, (see Part II,) which, being dissolved in water and acidulated, produces the finest Saxon blue. The liquid, separated from the precipitate, may be employed for a less perfect shade of colour. Materials to be dyed in the sulphuric blue vat should be dipped into a solution of alum, and then into the blue liquid, to which an excess of carbonate of potassa has been added, by which means a basic ceruleo-sulphate of alumina is attached to the fibres; or they may be dipped into a warm solution of chloride of barium and bitartrate of potassa, and then into an acid solution of the blue liquid, which produces a precipitate of neutral ceruleo-sulphate of baryta; the latter is more permanent than the former, but at the same time, more expensive.

It is difficult to ascertain the amount of indigo annually employed in dyeing, but it is probable it cannot fall short of 14 to 15,000,000 pounds. In England, about 1,700,000 pounds were imported in 1785, 3,600,000 in 1800, 5,000,000 in 1820, and over 7,000,000 in 1836.

Civil Engineering.

Letters from the United States of North America on Internal Improvements, Steam Navigation, Banking, &c., written by Francis Anthony Chevalier de Gerstner, *during his sojourn in the United States, in* 1839.

[Translated from the German, by L. Klein, Civil Engineer.]

[continued from page 255.]

LETTER X.

5. *Railroads in England.*

Although it is maintained that the oldest railroads were found in the mines in Germany, the merit of first having railroads used for the transportation of passengers, and of having introduced upon them

locomotive engines, belongs to the engineers and mechanics in England. It is only to be regretted that the immense cost of construction of the English railroads, and the expenses of working many of those where inclined planes have been adopted, have produced very unfavourable results for the Stockholders, and a bad impression on the subject of railroads on the continent. The railroad which is generally held up as an example for all others, viz. that from *Liverpool to Manchester*, is thirty-one miles in length, and has cost, up to the 31st of December, 1837, according to the report of the Directors, £1,360,095 stg., or per mile, 213,228 dollars. If the average be taken for the first three and a half years, during which the road has been in operation, the charge per passenger per mile, was three and three quarter cents, or one-fourth less than on the American railroads. Upon the Liverpool and Manchester railroad, there are transported, annually, 500,000 passengers, 250,000 tons of merchandize, and 100,000 tons of coal. The gross income was, in the year 1837, £226,000 stg., or per mile of road, 35,431 dollars, which income is indeed 11½ times as large as on the American railroads, where it averages only 3075 dollars per mile; but compared with the cost of construction of 20,000 dollars, and 213,228 dollars per mile, we find the income in America to be fifteen per cent., and only one per cent. more on the Liverpool and Manchester railway. This explains why the net income of this road, upon which there is a greater traffic than on any other railroad in the world, was never more than seven to eight per cent. on the capital of construction; the Stockholders, though, received an annual dividend of from nine to ten per cent., but only for the reason that over £500,000 stg. have been obtained in loans at four per cent., the surplus interest on this capital therefore devolves upon the shares and increases the dividends.

The second great railroad, of 112 miles in length, extends from *London to Birmingham*, and cost £4,500,000 stg., or 195,000 dollars per mile. The other railroads in England generally cost less than these two, but still too much to serve as models for the works on the continent. Even in England, the shares of only five railroads are now over par, those of all other railroads are, notwithstanding the low rate of interest, sold below par. In the whole, there are now in England about 800 miles of railroads in operation, of which about 300 miles serve only for the transportation of coal. If to these 800 miles be added 300 miles for Austria, 150 miles for the other States of Germany, 150 miles for France, 159 miles for Belgium, and seventeen miles for Russia, we have, in total, 1576 miles of railroads now in operation in Europe, while, already at the close of 1838, 3000 miles of railroads were completed in the United States of America.

6. *Railroads in Russia.*

Until the year 1834, when I first went to Russia, the engineers there regarded railroads as quite impracticable for that empire. On my application, His Majesty, the Emperor, gave me an exclusive privilege for the formation of two railroad companies, the one for a railroad from *St. Petersburg to Zarskoe Selo,* and the other, for one from St. Petersburg to Peterhof. I formed afterwards a company for the establishment of the first railroad, and the charter for the same was granted on the 21st of March, 1836. Soon after the construction of the road was commenced, it was partly opened already on the 21st of September, 1836, and the whole line was put into operation on the 30th of October, 1837. This railroad is only seventeen miles long, but forms, in its whole length out of the city of St. Petersburg, a straight line; the greatest rise is within the city, and but 10½ feet per mile. An embankment was erected the whole length of the road, which contains over one million cubic yards; this embankment was covered with a bed of stone and gravel, fourteen inches high, upon which the cross ties or sleepers were laid three feet from each other, supporting iron rails of sixty-five pounds per yard, which were fastened in chairs upon every sleeper. The space between the cross ties was then filled in with broken stone or gravel, and covered with sand. The grandeur of the whole structure was in correspondence with the expected traffic, as it was estimated that 300,000 passengers each way, or 600,000 in the whole, will travel over this road in one year. But this solidity in the construction, the high price of the iron in the year 1836, and of the stones and gravel in the marshy district of St. Petersburg, as also a great many unforeseen expenses, which generally take place in a new enterprize of this kind, increased the cost of construction so much, that for the road itself of seventeen miles in length, with a single track, 4,000,000 of rubles were expended, which is 50,000 dollars per mile. This comprises, however, the purchase of six locomotive engines, forty-four passenger cars with 1878 seats, and nineteen freight cars. The company having got permission to erect a large hotel in the park, at Pawlowsky, and another at Zarskoe Selo, they expended for these two hotels, and for some other buildings, 1,000,000 of rubles; therefore, in the whole, 5,000,000 of rubles, or 1,050,000 dollars.

During the winter of 1837—1838, the Directors of the Company permitted only a few trips to be made during some days of the week; the daily regular trips between St. Petersburg and Zarskoe Selo, commenced on the 4th of April, and those to Pawlowsky, on the 22nd of May, 1838. According to the printed report, made to the

Stockholders at their general meeting, the results of the operations of this road for the year 1838, have been as follows, viz:

The number of passengers from 1st April to 31st December 1838, was	597,665
If reduced to the whole length of the road, this number is equal to	423,129
The total receipts from passengers, were	161,872 dollars.
Each passenger paid, therefore, at an average, for seventeen miles,	38¼ cents.
Which gives the average charge, per passenger per mile,	2¼ cents.

The number of trips made by the locomotives, was 3500, and the average number of passengers per trip, 121. All the trains together, performed, therefore, a distance of 59,500 miles. The current expenses have been:

For maintenance of way and buildings,	$ 23,485
Transportation account,	36,810
General expenses, cost of administration, &c.,	30,340
Expenses for amusements,	14,226
Total,	$ 104,861

If this sum be compared with the number of miles traveled by all the trains, or 59,500, we find the expense per mile of travel, equal to 180 cents. In Belgium this expense is only 105 cents, and the trains contain, at an average, 143 passengers. In America, the expense per mile of travel, is only 100 cents, while the average number of passengers in a train, is forty.

The expense per mile of travel, 180 cents, divided by 121, gives 1.49, or nearly one and a half cent as the expense per passenger, per mile, which is twice as much as on the Belgium railroads.

The gross income during nine months, was 161,872 dollars, the net income, according to the accounts, 63,068 dollars, or thirty-eight per cent. of the gross receipts. The Stockholders received a dividend of four per cent. for these nine months.

The Directors mention in their report, that during the *whole* first year the road has been in operation, the number of passengers was 707,091, and the gross income 193,734 dollars. For the next year they estimate the income at 23,579 dollars, and declare, that there is a prospect, the net profit will be over forty per cent. of the gross revenue. In this case, the net profit would be 92,632 dollars, and after deducting 18,947 dollars for the interest and sinking fund on the loan, there will remain 73,685 dollars as dividend for the Stockholders, or exactly ten per cent. on the capital stock of 736,850 dollars. The

whole result of the operations agree very accurately with my first estimates; the number of passengers reduced to the whole length of the road, will be 600,000 per year; and already three years ago, I offered the company to rent the rail road, and pay the Stockholders during three years, a dividend of ten per cent. per annum.

The experience in the management of railroads during the last three years, has, however, shown that the expenses are much larger than was formerly expected, and at the present time, when this experience from the railroads in Europe, and a much greater one from those in the United States is before me, I must declare that it is quite impossible to defray the current expenses of the Zarskoe-Selo railroad, as it is now managed, with sixty per cent. of the gross income. As yet, this railroad is not reduced to its own resources, because the Directors proposed to make another loan of 300,000 rubles, (63,158 dollars,) to complete the same; and as long as money is expended at the same time, for the construction of the road and its operations, there can, even with the best will, never be made a strict division of the expenditure. No accurate results concerning the expenses of the operations of the Zarskoe Selo railroad, will therefore be obtained in 1839, and as long, hereafter, as the construction account is not entirely closed.

Several months since I proposed to the Directors, some arrangements and improvements, from which none but the best results can be expected. They consist, principally, in the following:

1. To continue the railroad from its present termination, to, and along, the Fontanka canal, a few wersts, in order that passengers might be taken from different points in the city, and brought, by horse power, to the general depot. All the large cities in the United States, as New York, Philadelphia, Baltimore, and New Orleans, are traversed by railroads, which, with a peculiar construction, turn round the sharp corners of the streets frequently with a radius of only forty feet, and the eight-wheeled cars, of fifty-two feet in length, never run off the track. The advantage of continuing the railroads through cities, is very great for the Stockholders and the public in general, principally where the lines are short.

2. To introduce eight-wheeled passenger cars and American locomotive engines, and to apply to their purchase the reserved fund, which, according to the statutes, is to be from ten to thirty per cent. every year of the gross income, and destined for the renewal of the depreciated stock.

3. To use wood as fuel for locomotive engines. The coke hitherto used as fuel upon this road, is imported from England at a very high price. There is no coal between St. Petersburg and Moscow, and it

can never be expected that the fuel for such an immense railroad as that between those two cities, will be procured in the same way. My attention in America was therefore also directed to this subject; upon more than 100 railroads, wood is used here as fuel, and it was to be expected that something effective had been invented, to prevent the throwing out of the sparks. It was principally in the South, under the thirtieth degree of latitude, that I found an apparatus in use, which seems to answer perfectly in every respect. By means of this apparatus the sparks are led through a partial vacuum, and fall down to the bottom of the smoke box; there is no wire net on the top of the chimney. This apparatus has been in operation for eighteen months, during which time not a single accident occurred, although cotton and other articles are daily transported in open cars. It is easy to show that by the use of wood as fuel upon the Zarskoe Selo railroad, the sum of 10,000 dollars might be saved in one year.

It is only with the introduction of the above stated improvements, that the Stockholders of the Zarskoe Selo railroad may expect a dividend of ten per cent. per annum, and as I am now so well acquainted with the experience in America, I do not hesitate to offer them again a yearly dividend of ten per cent. for the next three years to come, to pay besides, 90,000 rubles per year as interest and sinking fund on the loan, and to pay for the general depreciation of the locomotives and cars, an American train consisting of a locomotive with tender and a number of passenger cars to accommodate 400 passengers.

The advantage of the construction of the Zarskoe Selo railroad to the Russian empire, is far greater than to the Stockholders therein interested; because this railroad has been used in the changeable climate of St. Petersburg, in summer and winter, without the least interruption, the trips were regularly continued during the time of the greatest frost and the severest snow storms, and every body became convinced of the practicability and usefulness of this new kind of communication. This favourable result has produced the effect, that the project for a railroad from *St. Petersburg to Moscow*, which I brought into notice already three years ago, finds every day more and more supporters, and at present there are certainly but few individuals in Russia, and none abroad, who, with the knowledge of the intercourse existing between the two cities, are not convinced of the utility and necessity of this railroad. The population of St. Petersburg is 470,000, that of Moscow 330,000; the population of the towns and other places on the road, exceeds 200,000 souls. This railroad would therefore, in its length of 420 miles, form a line of communication for one million of inhabitants, residing on the same; and besides, the railroad would be traveled over by those numerous

travelers, who, from all parts of the empire, pass through Moscow to St. Petersburg.

The enormous intercourse between the two cities, which is not to be met with on any other line, neither in nor out of Europe, may be best judged of from an account kept, by order of His Majesty the Emperor, of all vehicles which passed over the turnpike from the 1st of January to the 31st of December, 1834. In that year, there were counted at Tshetire-ruki, on the turnpike road to Moscow, five miles from St. Petersburg:

96,201 traveling carriages of every description, drawn by - - -	269,799	horses.
23,879 post carriages and post sledges,	62,171	"
1,133,603 freight wagons or sleighs, drawn by - - -	1,187,402	"
Total, 1,253,683 vehicles, drawn by	1,519,372	horses.

This intercourse is so great, that it would justify the construction of a railroad more than it was ever the case in any line of this length; it remains only to inquire what would be the cost of construction of this railroad.

The Americans have constructed 3000 miles of railroads, and expended for the same, at an average, 20,000 dollars per mile; as only 35,000 passengers, and 15,000 tons of goods are transported annually over these roads, they have but single tracks, and the whole management is such, that the capital of construction bears five and a half per cent. interest. The traffic upon the St. Petersburg and Moscow railroad will be at least ten times as great, and therefore a much larger capital may be invested there than in America.

Already in the year 1835, I personally made a preliminary survey of the country between St. Petersburg and Moscow, and convinced myself that in the greatest part of the line the country is uncommonly favourable; since that time, I have continued to collect every important information in regard to this railroad, and with the knowledge of the experience in America, I may state without hesitation, that a railroad from St. Petersburg to Moscow, with a double track, with as heavy rails as those upon the Zarskoe Selo railroad, with all the necessary buildings and outfit, may be established for the sum of 125,000,000 of rubles, (26⅔ millions of dollars,) and that I will undertake to finish the whole railroad in a term of not more than six years.

It will, perhaps, be objected, that the Zarskoe Selo railroad, of 17 miles in length, with but a single track, has cost 5,000,000 of rubles, that therefore, in proportion to the length, the 420 miles to Moscow must

cost 125,000,000, in which sum would be comprised, it is true, the purchase of the proportional number of 150 locomotive engines and of 1600 passenger and freight cars, but the railroad could only have a single track. I have had occasion to remark already, in my former reports, that the cost of one railroad can not lead us to determine the cost of another, as the expenses of construction can only be ascertained by the special estimates; but here it may also be remembered that of the whole cost of the Zarskoe Selo railroad, the fifth part was expended for buildings alone, which, in proportion to the length, would give 25,000,000 rubles for the railroad to Moscow. The cost of the buildings for this road, however, as they will be constructed solely to accommodate the traffic, and not for amusements, will not be more than 4,000,000 rubles, and the remainder 21,000,000 are, with the present prices, just sufficient for making the superstructure of the second track throughout the whole line. There only remains therefore, the expense of grading for the second track to be provided for, and this sum will be richly brought in by the introduction of such a construction of the railway as will conform to the present experience in the two continents.

The connection of the centre of the Russian empire with the most important commercial city in the South—of *Moscow with Odessa*—has also been hitherto regarded as highly important. The construction of a canal is quite impossible; the construction of a turnpike, and more yet, its maintenance, would, with the entire deficiency of stone and gravel, be too expensive. Nearly all the railroads in the Southern States of North America, as also those in Belgium, are constructed without stone or gravel, because the latter are as rare there as in Russia; and in every case, would the maintenance of a railroad between Moscow and Odessa be cheaper than a macadamized road. The distance between the two cities is about double that from Moscow to St. Petersburg, and as the country is, throughout, very level, there is no difficulty to construct this railroad, with a double track, and heavy rails, for 175,000,000 of rubles, (or 37,000,000 of dollars) at the most. Both railroads could easily be completed in ten years.

A third railroad, which is supported, principally, by the population of Moscow, is that from *Moscow to Kolomna*, and the river Oka. The surveys and plans for this railroad were made by several engineers, during three years, from 1836 to 1838, with all the necessary detail, under my superintendence, and the estimates now completed. The length of the railroad to the river Oka, is $66\frac{2}{3}$ miles, and plate rails of sufficient strength, (manufactured in Russia,) might be employed for the same. The railroad would have a single track with sidings, and the arrangement be such that no inconvenience would

be experienced in the operations. The passengers, and no doubt, also a great quantity of goods, would be transported from the end of the railroad upon the river Oka to Nishney Novgorod, situated on the confluence of the rivers Oka and Wolga, where, annually, the celebrated great fair is held for the merchants of Europe and Asia. According to my estimates, made here, the railroad and four steamboats, would cost 11,000,000 of rubles, (2,315,800 of dollars,) and I offer to complete the road in two years, provided that I meet with no obstacles in directing the construction.

The way in which the above mentioned capitals for the construction of the railroads, may be procured, will be easily found out, if my former nine letters are read with attention. Sixteen millions of Americans have, within ten years, completed 3000 miles of railroads, at an expense of 60,000,000 of dollars; why should not Russia, whose European possessions are as large as the United States, and populated by three times as many, or 48,000,000 of inhabitants—why should this immense empire not also expend, in ten years, the sum of 60,000,000 of dollars for the railroads between St. Petersburg, Moscow, and Odessa. In Belgium, 56,618 soldiers were carried, last year, upon the railroads; what a gain would not result to the Russian war department alone, from the establishment of railroads! With the adopted width of track of six feet, and the introduction of the American plans of construction, horses, cannons, munition, wagons, and all other objects, will be transported with the greatest facility, and it might be proved, that the saving in the cost of transportation of the Russian troops and their munitions, during the late three wars with Persia, Turkey, and Poland, would have covered the whole cost of construction of the railroad from St. Petersburg to Odessa; and besides, the duration of the war would have been materially shortened.

Times were never more favourable for great enterprizes; Europe is in the enjoyment of profound peace; money may be obtained at the lowest rate of interest, and will be easily procured for the Russian undertakings, if to their partakers, advantages and guarantees are allowed, similar to those given in other parts of Europe, and in the United States of America. In such large undertakings, however, for which more than the ability of the natives is required, the question of nationality must be laid aside, and every body must be regarded as a native, who has made himself meritorious by the introduction of useful objects, which promote the prosperity of the nation. The Russian government has, principally in the last four years, accomplished what may be termed enormous; it can, and will, therefore, also execute that grand and national work.

Extracts from the Treatise on Geodesy. By L. B. FRANCŒUR. *Translated by* W. H. EMORY, *Lieut. U. S. Topographical Engineers.*

[Translated for the Journal of the Franklin Institute.]

The translation of Francœur's work on Geodesy, was commenced for the purpose of improving the translator's knowledge of a subject which forms a part of the duties of his corps. It has since occurred to him that the work would be useful to the public.

The frequent demands made by the general and state governments for topographical information with regard to particular localities, induces the belief that at some day not far distant, our legislatures, both state and national, will follow the example of other civilized governments, and consummate the desirable object of having complete maps of the territory within their respective limits.

The great survey of the coast undertaken by the general government, and conducted by Mr. Hassler, is, in fact, the commencement of this system, and will form the basis of all minor surveys of the different states and the inland frontier.

Even with the present demand for information upon the subject of surveying, the work cannot be unacceptable, as it will tend to give form, precision, and consistency, to surveys conducted for internal improvements and local purposes.

The name of the illustrious author, Francœur, renders unnecessary any commendation of his treatise. It may not be improper to say, however, that it is considered in Europe, the standard work on geodesy.

The valuable notes interspersed through the text, are by Major Bache, of the Topographical Engineers, to whom the translator feels an obligation which he is sure will be shared by the reader.

Book 1st.—Topography.

1. If we take a portion of country and suppose perpendicular lines to pass through every point, the intersection of these lines with a horizontal plane will form what is called the plan. The projection of the plan is composed of these intersections represented on paper. In this are to be traced the sinuosities of rivers and roads, the outlines of woods, the boundaries of fields and enclosures, and all the other features of the country, both natural and artificial.

Every part, when represented, preserves its true relation of size, form, and distance, reduced by a scale, and presents the same appearance as if the whole of the objects were seen at the same time from a great elevation, with a glass, which diminished their size.

Topography teaches the projection of plans, leveling, and land surveying, or the measurement of areas, and the art of delineating ground. This last division not involving geometrical considerations, will be omitted in this treatise.

Chapter 1st.—*The Projection of Plans.*

We shall explain the construction and use of the different instruments required in topography, except those used in geometrical drawings, such as the rule, the triangle, the dividers, the drawing pen, &c., which are too well known to require a notice here.

The art of projecting plans consists chiefly in a knowledge of instruments, and the merit of the surveyor depends, in a great measure, on his skill in using them.

2. *The Scale.*—Every plan should be accompanied by a scale, which shows the proportion the plan bears to the ground. The most usual way of making a scale is to draw on the plan a right line, which is divided into equal parts, and numbered; each part designating an unit, as a mile, a foot, an inch, or a tenth of a foot, &c. In Fig. 2, plate 1, one of these parts is divided into tenths. If it is required to take off four units and six tenths, place one leg of the dividers on the division No. 4, and the other on the subdivision No. 5, on the left hand of zero. If the unit represents a foot, we obtain four feet and five tenths, or fifty-four inches; if a mile, four miles and six tenths.

The relation between the distances on the plan and the objects themselves, is frequently expressed by a fraction. If for example, a foot on paper represents a mile on the ground, the scale of the plan may be expressed by the fraction one five thousand two hundred and eighty; a foot being the $\frac{1}{5280}$ part of a mile.*

The plans of the great map of France, by Cassini, are on a scale of $\frac{1}{86400}$, a line [.091 of an inch,] representing 100 toises, [221.5 yards.] The scale adopted by the war department, is $\frac{1}{80000}$, a millemetre, [.3937 of an inch] representing eighty metres, [87.491 yards.] The scales used in the *cadastre*,† are $\frac{1}{5000}$, $\frac{1}{2500}$, and $\frac{1}{1250}$, and as the ground is more or less cut up into small parcels, a millemetre, [.3937 of an inch,] representing in these cases, 5, [5.4658 yards,] $2\frac{1}{2}$, [2.7329 yards,] or $1\frac{1}{4}$ metres, [1.3664 yards.]

3. When great precision is required, the transversal scale‡ is used. Fig. 3 is a scale of this kind. The least part that can be measured is

* The French now use a metrical system, viz., a myriametre, a kilometre, a hectometre, a decometre, a metre, &c., each unit of division being a tenth of the next greater one.

† The public register, in which is recorded the quantity and value of lands (like the doomsday book in England.)

‡ Commonly called diagonal scale.

extremely small, as it is contained 100 times in each principal longitudinal division, or ten times in every sub-division. The oblique lines enable us to measure the small parts in the following manner. Place one leg of the dividers on the transverse line marked 300, and the other upon the oblique one numbered eighty, the distance being measured along the longitudinal line No. 4, (for it is necessary that both legs of the dividers should be on the same longitudinal line,) the length measured will contain 384 parts, which will be 384 tenths of inches, feet, yards, or miles, according to the value assigned to the unit of division.

4. *The Protractor.*—This instrument, represented in figures 5, 6, and 8, is used to trace angles on paper, or to measure them when traced. It is a semicircle of brass or horn, divided into degrees and half degrees, from 0° to 180°. It is numbered either from the right or the left, and on a concentric semicircle it is numbered in a contrary direction, from 180° to 360°, in order to measure the arcs, which exceed 180°.

To measure an angle already traced on paper, apply the diameter of the protractor to one of the sides, A C, (fig. 7,) so that the centre shall be on the apex C of the angle, the other side, C K, cuts the circumference in a point, K, where we read the angle, which is 54°.

To construct an angle L O K, (fig. 6,) of an even number of degrees, thirty-six for example, place the protractor so that the radius of the thirty-sixth degree shall fall on the line I K, which is to be one of the sides of the angle, and at the same time, place the edge *ab* on the point E, through which we wish the other side to pass. The line L O, which, by the construction of the protractor, is parallel to the diameter A C, will make an angle of 36° with the line O K.*

These protractors, however, afford but an imperfect means for measuring or constructing angles, and as an improvement, that represented in fig. 8, has been contrived. It consists of a graduated semicircle as before, with a movable rule, to which is attached a vernier, by the aid of which minutes can be read, (vide No. 9, on the use of the vernier and its construction.) The centre of the circle is in the middle of an opening, which is defined by the crossing of two hairs. Care must be taken in the construction of the instrument that the edge I D of the

* In this example the angle is drawn through a point removed from the given line. A more frequent case is where the point is on the line. Then the diameter of the protractor is placed on the given line, with the centre at the point, when the required angle is marked off. A perpendicular to the given line should be drawn, in the first instance, through the point, to guide in laying down the protractor in its true position, as the line passing through the graduation at 90°, should be coincident with it.

rule prolonged, shall, in all its positions, pass through the centre of the circle*. However, it is still more exact to use a scale of cords. Fig. 4 is a scale of cords. To use it, describe first the arc of a circle, A K, (fig. 7,) with a radius equal to the cord of 60°, (taken from the scale,) which we know is the side of the inscribed hexagon; then take from the scale, with the dividers, the cord of the given angle, 54° for example, apply it to the arc described, and the radii drawn through the two points, A K, where the points of the dividers touch the arc, will make with each other the required angle. To save space, fig. 7 is drawn from scale fig. 4: the distances being reduced to one-fifth.

To give this construction greater precision, in place of taking the length of the cord from fig. 4, calculate the length in parts of the radius by means of the equation No. 35, or take the numerical value from the table, (see Francœur's course of Math. and his Geometry;) then take this distance with the dividers from a decimal scale, which will be the length of the cord to be applied to the arc A, K. Thus the cord of 54° is 9080, the radius being 10.000: with

* The circular protractor is a still more perfect instrument, and gives results of far greater accuracy. It is numbered throughout the entire circle from 1° to 360°, and reads by means of verniers to one minute, 30, 15, and in some instances, to 10 seconds; the diameter of the instrument varying according to the minuteness of the divisions. It is furnished with arms provided with points, by means of which the given angle is marked on the paper. These arms, for safety and convenience in transportation, fold up on the body of the instrument. This protractor has the advantage, not possessed by those less than a circle, of correcting by means of opposite verniers, the errors of eccentricity, &c., which belong, more or less, to all graduated instruments. It is, likewise, susceptible of ready adjustment, and is not easily deranged. The movement of the arms is effected by a pinion working on a fine ratchet on the periphery of the circle. For laying down the protractor on any given point, four short lines are marked on the interior edge of the principal circle, which indicate the prolongation of two lines at right angles to each other, and intersecting at the centre of the instrument.

The description of another protractor, and one which has found general favour for railroad, canal, and other surveys, within the last few years, may not be unacceptable in this place. It is likewise circular, and consists of a printed sheet so designed, by means of lines of unequal lengths, that the divisions of 10°, 5°, and 1°. and the fractional parts of a degree, readily catch the eye. It is prepared without letters or figures, in order that the draftsman may assume any one of the principal divisions for the zero or meridian line, as best may suit his purpose. The original plate for printing these protractors, was engraved in 1829, and had a circle of twelve inches in diameter graduated to fifteen minutes. It was sufficiently large to print on medium paper, without leaving any marginal ridge, which is always made when the paper is larger than the plate. To avoid the error which would otherwise occur, the impressions are obtained on dry paper; though this precaution is not sufficient to secure absolute accuracy to the protractors, as the great pressure necessary to give the lines sufficient distinctness, stretches out the paper unequally, which, on coming from the press, assumes its original form. The figure thus becomes slightly elliptical, but not so much so as to offer any practical objection to the usefulness of the plan. The facilities which this protractor affords in plotting, generally, will readily suggest themselves. It is hardly necessary to say, it is not intended for use in final drafts or maps, but to obtain results to be transferred to them.

a radius of 10,000 parts of any scale, describe the arc A K, upon which apply the cord A K of 9080 parts of the same scale.

5. *Signal Staves.*—These are straight poles shod with iron that they may be stuck in the ground. A small white board or a sheet of paper is fastened to these staves when it is required to see them at a great distance.* They are planted in different parts of the country as signals, and may be used to run straight lines, by an observer getting two of them in range, while an assistant under his direction places others at intermediate points.

The Chain.—Short distances are measured with a rule; long distances with a chain. The chain is formed of links, or more properly of rods of large iron wire turned at the end into small loops and connected with each other by rings. The length of a link measured from centre to centre of the consecutive rings, is six inches. There are 100 links in a chain, so that a chain is fifty feet in length.† Each end of the chain has a handle which makes a part of its total length. For convenience in measuring distances less than a chain, there are brass markers at every ten feet.

The effort which is constantly made to stretch out the chain in useing it often increases its length. It is therefore necessary to submit it frequently to some test, such as applying it to the exact distance marked on a wall or floor, in order that the operator may be assured that the chain is of the proper length.

The operation of measuring is performed by two chain bearers, called *leader* and *follower*, and is commenced by placing poles in the direction to be measured. Departing from the first pole, the *follower* holds his handle on the ground at the point of departure *a*, (Fig. 1,) and the *leader* proceeds on the line in the direction of the second pole; taking out any kinks in the chain, and avoiding stones, tufts of grass, or any thing that may derange its right line direction. He then sticks a pin in the ground at the extreme point *d* of the chain. The pin is a piece of iron wire with a loop‡ at the end for the purpose of suspending it from the person by a hook. The pin being stuck, the chain-bearers proceed, the *leader* dragging the chain until the *follower* ar-

* Small white flags, or flags of white, red and black, of different sizes and shapes, and variously combined, form good signals and are easily distinguished one from another.

† In the original work, this chain consists of 50 links of two decimetres each, or 100 decimetres. An addition of five millemetres (.19685 of an inch) is made in the length, (32.81 feet nearly) to compensate for the thickness of the ring, and the difficulty in stretching the chain.

The fifty feet chain is used in the United States for military, railroad and canal surveys, and the two and four pole chains for land surveying.

‡ This loop is also useful to attach small strips of white or red cloth, to guard against losing the pins in bushes, cane-brakes, high grass, &c.

rives at the pin, when he places his end of the chain against it, and the *leader* stretches the chain and fixes another pin, and so on to the end. The *follower* takes up each pin as he comes to it, and keeps it; the number he gets denoting the number of chains measured. If the distance exceeds ten chains, the *follower* on taking up the tenth pin, returns the whole ten to the *leader*, and records it in his book.* The distance of ten chains thus noted is called a tally. Every measurement should be taken parallel to the horizon. When the ground slopes, or there are impediments, the chain must be held horizontally above the ground. But as the chain swags from its own weight, this is impracticable, and the measurement is therefore not entirely exact.

Alidade.—This instrument is of various forms, but in describing one, all the rest will be easily understood. It is a movable rule which is directed towards different objects, whose relative position we wish to determine, taking the objects as points to sight upon. This rule (fig. 10) has at each end perpendicular limbs A B, C D, which can be removed at pleasure for the convenience of transportation. These limbs are called pinnules, or sights. A, is a very narrow vertical slit, to which the eye is applied, and opposite is a rectangular opening, in the middle of which, and perpendicular to the rule, is stretched a thread of silk or a horse hair. The plane passing through this thread and the slit opposite passes likewise along the edge I D, of the rule. As it is convenient to use the sight which is nearest, both are provided with a slit, and a rectangular opening and thread; the slit in one of them being placed below, and in the other above the rectangular opening.

To see a signal, turn the alidade in the direction of the object, so that the visual rays which pass through the slit and the thread shall coincide with the object. The plane of these visual rays is perpendicular to the plane of the rule, and should also coincide with its edge I D. To verify the fact, direct the instrument on an object, and draw a fine line along the edge of the rule; then turn the alidade, end for end, and, if in adjustment, its edge will coincide with the line drawn; should this not be the case, the thread must be moved until the error disappears.

Instruments used in measuring angles, which have arcs of circles, are similar in some respects to alidades; but they have a movement about a centre, (see what follows and fig. 22.)

8. When signals are too distant to be observed with the naked

* If eleven pins are used, which is a better number, the ten pins forming the tally are returned to the leader on the eleventh pin being stuck in the ground, and which then becomes the first pin in the next tally.

eye, a telescope is used in place of the simple sights. It contains two lenses, one towards the object, called the object-glass, and the other towards the eye, the eye-glass. The two glasses are placed at such a distance apart that their respective foci are nearly at the same point in the interior of the tube. In this focus, common to both, is a diaphragm, across which two threads are stretched at right angles to each other. This diaphragm is movable along the tube of the telescope, and can, by this means, be placed exactly in the common focus of the two glasses, (see 103.)

When the telescope is directed on an object, the signal should appear directly on the intersection of the hairs, or in coincidence with one of them. This telescope inverts objects, but no inconvenience results from this circumstance. It is mounted on a stand, above the alidade, and has a motion in a vertical plane.

9. *Vernier, Nonius.*—The fractional part of a division of an instrument divided into equal parts, is read by means of a small metallic plate, which moves in contact with the divisions, and is itself divided into equal parts. If the space occupied by n—1 of the principal divisions be divided into n parts on this plate, the nth part of the length of the principal division can be read by the aid of it. This contrivance is called a *vernier*, or *nonius*, after two geometricians, one of whom invented, and the other brought into general use, this valuable auxiliary to accuracy. The theory of the vernier is given in the following article.

H A I (fig. 11) is a fixed rule, divided into equal parts . . . 8, 9, 10 . . .; the small rule C D, which has a motion parallel to and along the first, is just the length, for example, of five of these parts, and is marked in six equal divisions, and numbered. Let us suppose the extremity C coincides with the 10th division. If we take one of the divisions of A B for a unit of measure, and compare the divisional lines of A B, and C D, we see that No. 1 of the small rule is higher than No. 11 of the large rule, by $\frac{1}{6}$ of the division assumed as unity; No. 2 is higher than No. 12 by $\frac{2}{6}$; No. 3 is higher than No. 13 by $\frac{3}{6}$; No. 4 higher than 14, by $\frac{4}{6}$; No. 5 higher than No. 15 by $\frac{5}{6}$; and lastly, that No. 6 is higher than No. 16 by $\frac{6}{6}$, or 1; that is to say, No. 6 corresponds exactly with the 15th division of the rule.

Now let the small rule C D, which is the vernier, be placed on the other side in the position C′ D′, and find the value of the fraction which is marked off at C′, or in other words, the length 13 *i*. To do this, see on the vernier and the rule what two divisional lines exactly coincide. In this instance No. 5 coincides with H, from which we conclude that the length 13 *i* is $\frac{5}{6}$ of a division of the rule H A, and that the point C′ reads 13 units and $\frac{5}{6}$ of a unit. For No. 4 is below 17, ;

No. 5 below 16,$\frac{2}{3}$, and so on to C', which is below 13,$\frac{4}{6}$. The No. 5 on the vernier which designates the division in coincidence, indicates the numerator of the fraction $\frac{5}{6}$ without taking the trouble to count the parts one by one. The units are here divided into sixths, because five of these units are divided into six parts on the vernier. Figure 12 is constructed on the decimal principle, nine parts of the scale making 10 of the vernier A B. According to this, the line *i* reads 57 units and $\frac{6}{10}$; the fraction being ascertained by remarking that the divisional line, No. 6 on the vernier, is the only one which corresponds with any divisional line on the scale.

The same reasoning applies to the case of a circle divided into equal parts (fig. 9.) Suppose the arm A C with the vernier I F fixed to it, movable around the centre C of the graduated arc A D. This vernier is terminated by a concentric arc which moves in contact with the divisions on the limb in every position of the arm A C. An arc of nine degrees of the large limb, embraced between I and F, and divided into 10 equal parts on the vernier, will read tenths of a degree. If the vernier is placed so that the last divisional line corresponds with the zero point of the graduated limb, the divisions of the vernier, will be above the corresponding divisions of the limb respectively $\frac{1}{10}$, $\frac{2}{10}$, $\frac{3}{10}$, &c.

If the vernier is placed in any other position, such as C B, we see that the zero point on it corresponds to 56 degrees and a fraction; this fraction expressed in tenths, is found, by observing that the sixth divisional line on the vernier is just on one of those of the arc; and hence the angle A B is 56° and 6 tenths.

In most instruments used to measure angles, the circle is divided into 360 degrees, and the vernier reads to minutes; the arc of the vernier being 59 degrees and divided into sixty equal parts. If the circle is divided into half degrees, the arc of the vernier is made 29 degrees and divided into 30 equal parts, and will give the thirtieth of a half degree, which is a minute. If we desire great precision in obtaining the parts of a minute, the circle and the vernier are divided into much smaller parts; but to do this, the instrument must be constructed with great care, and of large dimensions. If, for example, we wish to read to 5″, each degree of the limb is divided into twelve parts, each part occupying five minutes. Then take upon the vernier an arc of 59 of these parts and divide it into 60 equal parts, and the fraction will be $\frac{1}{60}$ of 5 minutes, or 5 seconds Repeating circles and theodolites are frequently divided with this minuteness; (see Nos. 92 and 105) but this precision is neither usual nor necessary in the ordinary surveying instruments.

Although the very small divisions of the limb and vernier of these

instruments, can only be read by the aid of a magnifying glass, the art of constructing them is carried to such perfection by the aid of machinery, that the equality of the divisions may be entirely relied upon. As it would be difficult to count the number of divisions on the vernier from the zero point to the division of coincidence, they are numbered at regular intervals of five or ten parts; the number expressing the minutes, or seconds, &c., as the case may be, to be added to the number of degrees marked on the limb, at the point indicated by the zero of the vernier.

An instrument well centered and well adjusted, gives results with astonishing accuracy.

When the vernier and limb are graduated into small divisions, it is frequently difficult to determine at which of two consecutive lines of division the coincidence occurs. In this case, the mean between them is taken.

10. *The Tangent Screw.*—This is an invention designed to communicate very slight motion to a piece which has a motion along another piece which is stationary.

If, for example, we wish to direct the telescope of a graphometer upon a signal, it is first directed very near the object. This being done, the purpose of the tangent screw is to place the object and the crossing of the hairs in exact coincidence.

The difficulty which this problem presents, consists in making the telescope independent of the tangent screw in its large movements, while in the small movements it shall be regulated by it. The following is a description of the manner in which this is done.

A B (fig. 16) is the limb of a graphometer; C D the arm, or movable radius which carries the telescope; D, a part of the arm, is a slider and carries along with it the screw V, which turns in a socket *b*. In an opening *a b* of the slider is lodged a piece of metal susceptible of being moved along in the open space for a short distance. This piece being attached to the arm C D, and the telescope, by means of the screw V, which acts as a connecting rod, carries with it a female screw *i*, in which the screw V bites; so that when this piece of metal is clamped to the limb and the screw V turned, the slider or arm D advances or recedes, and communicates a slight movement to the telescope with which it is connected. Under this fixture is a clamp with two springs, and provided with a clamp screw K. These springs release or hold fast the limb according to the direction in which the clamp screw is turned.

To use the tangent screw, loosen the clamp, and turn the arm C D, which carries with it the vernier, the tangent screw and the telescope, until the telescope is turned very nearly on the signal; then clamp the

piece of metal which carries the female screw *i*, to the limb by turning the clamp screw K. This done, turn the tangent screw V in the socket *b*. As this screw bites in the female screw *i*, which becomes fixed by clamping, it moves in either direction the slider or arm D, and imparts to the telescope a very delicate motion, by which the cross hairs in the diaphragm can be made to coincide with the signal.

The socket *b*, and the female screw *i*, are mounted on pivots, that the axis of the screw may always remain perpendicular to the arm C D, and that the screw may move freely by a slight touch.

One entire turn of the tangent screw moves the slider or arm along the female screw only a distance equal to one spiral, measured on the axis of the screw. If this distance is half a millemetre [.01968 of an inch] and the screw is turned thirty degrees, that is one-twelfth of an entire revolution, the arm will be moved only one twenty-fourth of a millemetre, [.00164 of an inch.]

The arrangements of the tangent screw vary with the form of the instrument, but are always according to the principles explained above. The vernier, instead of being placed in a rectangular opening at the termination of the arm, as in fig. 16, is more frequently placed at the side of it, as in fig. 9.

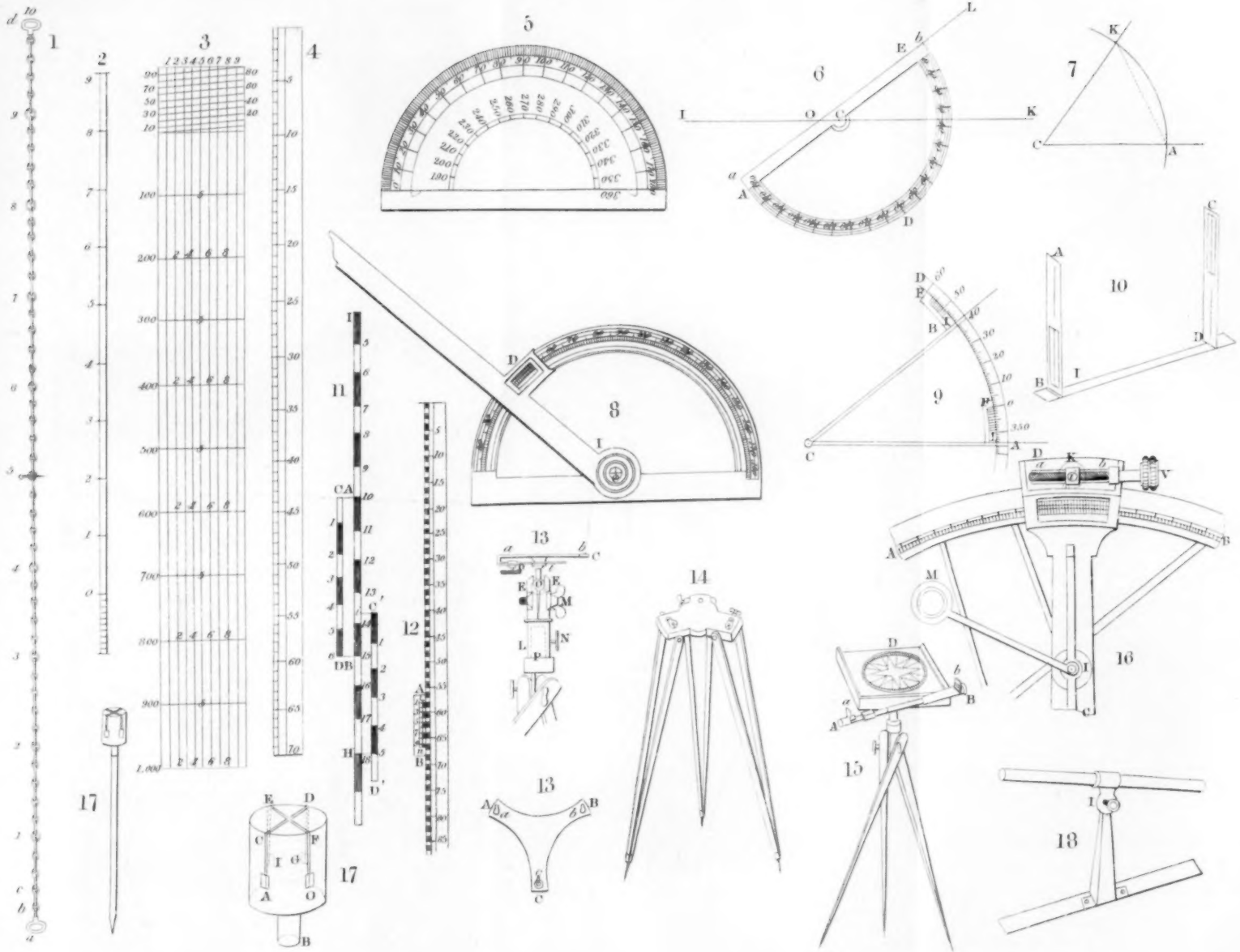
A magnifying glass M is attached to the arm, and revolves with it, for the purpose of reading the graduations on the limb and the vernier. It is furnished with a hinge at I to enable the operator to place it at the proper distance from the graduation to suit his vision.

11. *The Tripod.*—The stand which supports surveying instruments is called a tripod. It consists of three legs which can be so opened or closed as to allow the instrument to retain a horizontal position notwithstanding the inequalities of the ground. The legs forming the tripod are joined together by being screwed to projections from a metallic plate called a staff-head, which supports also the socket of the instrument. These staff-heads, and the arrangements for screwing the legs to them, are of various kinds. When the legs are thus secured at the top, and spread out at the bottom, a stand is formed sufficiently stable. The extremities of the legs are shod with iron. When the instrument is to be transported, the legs are removed from the staff-head, laid together, and bound by a movable band of iron.

The legs being light, sometimes yield in using the instrument.* To obviate this and give additional stability to the instrument, the legs should be made in the shape of a V, as in fig. 14.

12. *The Universal Joint.*—It is necessary that an instrument be

* This inconvenience can only occur to the most unskilful operator. The force of the wind is a more probable cause.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so joined to the stand that a horizontal, vertical, or oblique position, according to the nature of the observation, may be given to the limb. This junction is by means of the universal joint which admits of any of these positions for the instrument. There are various kinds.

The Ball and Socket.—This is composed of a short rod *i*, fixed to the instrument and terminated by a brass ball O (fig. 13.) The brass cylinder L N, which has at bottom a cavity to receive the staff-head, is terminated at top by two shells E E; these are two distinct pieces, concave towards each other, one of which is permanently fixed to the cylinder L N, while the other being free, can be brought in contact with, and pressed against, the first by means of the clamp screw M. By loosening the clamp screw, the ball can be moved in every direction, and the limb made to take any position desired. When the limb is in the desired plane nearly, the screw M is slightly turned, the friction being sufficient to retain the ball, at the same time that it will allow enough motion to place the limb exactly in position. This being done, the screw M is tightly clamped.

13. *Cugnot's Joint*, (fig. 19,) is composed of a nut N, formed of two cylinders whose axes are placed at right angles and one a little above the other. The bolts B′ B′, and B run in the direction of the axes, and are screw-tapped at one end to receive nuts.

When the joint is attached to the tongues L L, which carry the table of the instrument, we can by loosening the nut, move the table in two directions, perpendicular to each other, and consequently adjust it to a horizontal position. By tightening the nuts all motion ceases, and the table remains fixed in the given position. The movements given to the table by this means are precisely similar to those of *Cardan's suspension*, used in the mariner's compass and in chronometers, to preserve a horizontal position on board of vessels. Cugnot's joint is very frequently used in the plane table, an instrument which we shall notice hereafter.

14. *The Road or Slope Level Joint.*—This is a simple hinge which gives a vertical motion to a spirit level, and enables the operator to bring the bulb in the middle. As its motion is very abrupt, it cannot be used with any degree of accuracy without the aid of a tangent screw.

To be continued.

Statement of the performance of the Locomotive Engine, "Hichens & Harrison," built by Messrs. Baldwin, Vail & Hufty, for the Philadelphia and Reading Rail Road.

On February 9, 1841, the above engine hauled over the Philadelphia and Reading railroad, 54½ miles in length, from Reading to its

intersection with the Columbia railroad, a train of *one hundred and five* loaded burden cars, laden with 1318 barrels of flour, 870 kegs nails and spikes, 635 bushels grain, sixty-three tons of blooms and bar iron, twenty cords wood, eight casks oil, and sundry other articles of freight, amounting, in all, to 308½ tons of 2240 lbs.

Weight of the 105 cars, 173 tons, making a total gross weight of 481½ tons of 2240 lbs., equal to *one million seventy-eight thousand five hundred and sixty pounds*, hauled by the engine, not including her own, or her tender's weight.

Cars all four wheeled, wheels three feet diameter, lard and tallow only used in boxes. Whole length of train, 1260 feet, (or sixty feet less than one-fourth of a mile.) Running time, four hours fifty-four minutes, making an average speed of $11\frac{1}{10}$ miles per hour.

Total quantity of fuel consumed, 2.51 cords of oak wood.

Total quantity of water evaporated, 1804 gallons.

Oil used by engine and tender, seven quarts, including oiling before starting; longest continuous level over which the above train was hauled, $9\frac{1}{10}$ miles. Her speed, with the train on this level, $10\frac{9}{10}$ miles per hour.

Weight of engine, empty, 23,250 lbs. With water and fuel, 26,710 lbs. Weight on driving wheels, with water, fuel, and two men, 14,120 lbs. Cylinders, 12½ by 16 inches stroke; driving wheels, four feet diameter.

The above road has no *ascending* grade, from Reading *towards* Philadelphia, with the exception of half a mile, at its lower terminus, or intersection with the Columbia railroad, graded at 26½ feet per mile, on which grade the train was stopped.

The profile of the road, from Reading to this point, is divided into levels, varying from 1600 feet to $9\frac{1}{10}$ miles in length, and *descending* grades of from one and a half to nineteen feet per mile, the latter being the heaviest grade on the road.

Total length of level line between above points, $27\frac{8}{10}$ miles.

Total fall, from where the train was started to where it was stopped, near the Columbia rail road, 214 feet.

Shortest radius of curvature on the road, 819 feet; 1480 feet of curve struck with this radius.

The engine started the above train on a level, without any assistance, and gradually increased her speed to the average rate above mentioned.

She worked with great ease to herself during the whole trip; and hauled the train for the last fourteen miles, ten of which were level, over rails in very bad order, owing to a light snow storm, which moistened without wetting their surface; the effects of which, in di-

minishing the adhesion and power of the engine, practical engineers can well understand and appreciate.

The above performance is believed to be unsurpassed; and the train to be the longest and heaviest ever hauled by *one* engine on any railroad in Great Britain or America.

G. A. NICOLLS,
Superintendent Trans. Phila. and Reading R. R.

Reading, Pa., Feb. 10th, 1841.

Second Report of the Directors of the New York and Erie Railroad Company, to the Stockholders. February 3rd, 1841.

[CONTINUED FROM PAGE 265.]

APPENDIX.—NOTE A.

To E. LORD, ESQ., President, &c.

Sir—The subjoined statistical tables, having a bearing on matter connected with the great work of internal improvements, in which you are engaged, I have prepared with much care, and respectfully submit the same for the consideration of the stockholders of your company, and the public. Your obedient servant,

EDWIN WILLIAMS,
Compiler of the New York Annual Register.

New York, February 3rd, 1841.

1. *Annual consumption of country produce in the city of New York.*

The following is an approximate estimate of the annual amount of sales of articles of country produce, in the city of New York, for the consumption of the inhabitants.

Fresh Beef,	$ 1,470,000
" Veal,	365,000
" Mutton and Lamb,	335,000
" Pork,	600,000
" Poultry, Game, Eggs, &c.,	1,000,000
Salted Beef, Pork, and Hams,	1,200,000
Vegetables and Fruit,	1,200,000
Milk,	1,000,000
Butter, Cheese, and Lard,	1,500,000
Flour, Meal, and other Bread Stuffs,	3,000,000
Hay and Oats,	750,000
Fuel, (Wood and Coal) exclusive of Steamboat Fuel,	2,500,000
Articles not enumerated,	580,000
	$ 15,500,000

The above is not intended to include building materials.

The opening of a new avenue for supplying our markets, such as the New York and Erie railroad, which passes through a section of country well adapted to the furnishing of most of the above articles, would doubtless have the effect of reducing prices by increasing the abundance of supplies. This reduction may be safely estimated to

average ten per cent. on the above amount, thus saving, annually, to the inhabitants of this city, a million and a half of dollars.

2. *Increase of population, &c., in the Railroad Counties.*

Increase of population and wealth in the counties traversed by the New York and Erie railroad, and of adjacent counties and parts of counties in this State, as shown by the census of 1830 and 1840, and the taxed valuation of real and personal estate in the same years:—

Counties traversed.	*Census.*	*Census.*	*Value of real and personal estate.*	
	1830.	1840.	1830.	1840.
Rockland,	9,388	11,874	$1,696,790	$2,229,469
Three-fourths of Orange,	34,029	38,050	6,325,777	8,656,670
Sullivan,	12,372	15,630	1,215,750	1,319,586
Three-fourths of Delaware,	24,700	26,522	2,315,555	2,544,060
Broome,	17,582	22,348	1,785,168	2,361,737
Tioga,	27,704	20,350	2,398,002	1,906,747
Chemung,		20,731		3,015,592
Steuben,	33,975	45,992	1,476,340	5,787,282
Alleghany,	26,218	40,920	1,260,442	5,216,000
Cattaraugus,	16,726	28,803	1,249,018	4,149,073
Chatauque,	34,657	47,641	1,851,353	4,360,179
	Counties Adjacent.			
Two-thirds of Oswego,	34,248	32,942	3,588,730	3,879,397
Chenango,	37,404	40,779	3,481,314	4,293,438
Cortland,	23,693	24,605	2,169,119	2,320,720
Tompkins,	36,545	38,113	2,726,596	4,360,673
One-third of Cayuga,	15,982	16,787	1,384,711	4,170,885
One-third of Seneca,	7,010	8,289	1,008,043	1,726,318
One-half of Yates,	9,504	10,221	1,020,348	3,231,091
One-fourth of Ontario,	10,042	10,875	1,945,088	3,464,312
One-half of Livingston,	13,859	17,855	1,712,366	5,072,979
One-half of Genesee,	25,996	29,820	2,149,297	6,462,772
One-fourth of Erie,	8,928	15,538	724,781	3,471,378
	460,562	564,685	43,484,588	84,000,358
		460,562		43,484,588
Increase in ten years,		104,123		$40,515,770

3. TABLES SHOWING THE EFFECT OF INTERNAL IMPROVEMENTS ON THE VALUE OF PROPERTY IN THE CITY OF NEW YORK.

1. *Chronological Table of the Assessed Value of Real and Personal Estate in the city of New York, during three Commercial Periods.*

1*st Period*—From the close of the last war with Great Britain to the completion of the Erie canal:

Year.	*Assessed Valuation.*	*Year.*	*Assessed Valuation.*
1815,	$ 81,636,042	1820,	$ 69,539,753
1816,	82,074,200	1821,	68,285,070
1817,	78,895,735	1822,	71,289,144
1818,	80,245,091	1823,	70,940,820
1819,	79,113,061	1824,	83,075,676

2*d Period*—From the opening of the Erie canal, in 1825, to the completion of the Ohio canal:

1825,	$ 101,160,046	1829,	$ 112,526,016
1826,	107,477,781	1830,	125,288,518
1827,	112,211,926	1831,	139,280,214
1828,	114,019,533	1832,	146,302,618

3*d Period*—From the completion of the Ohio canal, in 1832, to the present time:

1833,	$ 166,495,187	1837,	$ 263,747,350
1834,	186,548,511	1838,	264,152,941
1835,	218,723,703	1839,	266,882,430
1836,	309,500,920	1840,	252,135,515

N. B. During the latter period, namely, since 1832, about 470 miles of railroad have been completed and put in operation in this State, besides about 2,500 miles of railroads in other States. Thus it will appear that since the introduction of the *railroad system*, the value of real and personal property in the city of New York has increased over *one hundred millions of dollars.*

The amount of tonnage of canal boats passing and repassing Utica, on the Erie canal, for one year, it is ascertained, is greater than that of all the foreign and domestic shipping entering and clearing at the port of New York. (*See R. R. J. Vol.* 4, *No.* 1.)

2. *Chronological Table of the Assessed Value of Real Estate only, in the city of New York, for a series of years:*

Year.	*Real Estate.*
1817,	$ 57,799,435
1820,	52,062,858
1823,	50,184,229
1825,	58,425,395
1828,	77,139,880
1831,	95,716,485
1833,	114,124,566
1834,	123,249,280
1836,	233,742,303
1839,	196,940,134
1840,	187,121,714

Increase of value of real estate in this city, since 1831, over ninety-one millions of dollars.

Assessed value of personal estate in 1840,	$ 65,013,801
" " " 1833,	52,366,976
Increase,	$ 12,646,825

Extract from a report to the stockholders of the Camden and Amboy Railroad Company, dated January 29th, 1840:—

"Two years since, at the request of some market people in New Jersey, a line called the Pea Line, with two cars, was occasionally started from Camden to New York, with no other view or expectation than the accommodation of a very useful and respectable class of men. This line has steadily increased, until it has become profitable beyond all expectation. During the past year, it has been running daily, sometimes taking with it as many as sixteen cars, laden at the appropriate season, with peas, peaches, potatoes, asparagus, cabbages, live stock; and upon one occasion, (incredible as it may seem) thirty tons of green corn. This, connected with the gradual increase on the other lines, will enable you to judge what you may fairly expect in a few years hence; always bearing in mind, that the expenses do not increase in the same ratio with the receipts, because the same capital can do a larger business, whilst the interest to be paid remains the same."

(Note B.)—Dunkirk Harbour.

Extract from the documents accompanying the President's Message to Congress, of December, 1837.

"The importance of the harbour of Dunkirk, in a commercial point of view, has heretofore been fully set forth. The surface enclosed by the government works, will be about two hundred and eighty acres, of which there are eighty acres of excellent anchorage, with clay bottom; and there is wharf room sufficient for the transaction of a very large business. It occupies a position nearly midway between Buffalo and Erie. It is extremely valuable as a port of refuge, and has been much resorted to for that purpose by steamboats and sail vessels; and it has been selected for the termination of the New York and Erie railroad through the southern tier of counties of the State of New York; a work, the completion of which will at once place it among the chief harbours on the shores of lake Erie. The number of steamboats and sail vessels touching at this port has, during the past season, greatly increased. From the opening of the navigation, on the 5th May, to the 30th September, 1837, the number of arrivals of steamboats was 630, whose probable tonnage amounted to 183,177 tons, and the number of passengers to 78,700. During the same period, the number of arrivals of sloops and schooners was 103. Shipping to the amount of 778 tons is owned at the port."

The above is taken from the annual report of T. S. Brown, *General Superintendent of the United States works at the east end of lake Erie.*

The distance from Dunkirk to Piermont, on the Hudson river, by the line of the New York and Erie railroad, is 446 miles. Including the *ferry*, the whole distance to New York city does not exceed 468 miles.

From Buffalo, by the way of Albany, to New York, the distance by railroad will be about the same, viz:—

Buffalo and Batavia railroad, (via Attica,)	-	39 miles.
Batavia and Rochester "	-	32 "
Rochester and Auburn "	-	78 "
Auburn and Syracuse "	-	26 "
Syracuse and Utica "	-	54 "
Utica and Schenectady "	-	78 "
Schenectady and Albany "	-	16 "
Albany and New York "	-	149 "
Total,	-	472 miles.

Dunkirk is forty-two miles west of Buffalo, on the south shore of lake Erie, and its harbour is occasionally open many days, and even weeks, earlier in the spring and later in the fall.

The line of the New York and Erie railroad being entirely in the hands of one company, the principle of charging less per mile in proportion as the distance traveled is greater, may be brought into action, and will, doubtless, result in great advantage both to the public and to the company. Passengers from Dunkirk to New York city, for instance, may be charged twelve dollars, which will be about two and a half cents per mile; whereas, way passengers traveling 100 miles or less, may be charged four cents per mile. As the superstructure will be heavy and substantial, passengers by quick trains may with certainty and safety go from Dunkirk to New York in from twenty to twenty-four hours, or at the average speed of twenty miles an hour, including stops.

If we compare this with the state of things at present existing on the northern line, and which will probably continue for a considerable time to come, we shall see that there, in consequence of there being eight different corporations, each of which, until compelled by some strong inducement to the contrary, will charge the full rate of four cents per mile, the price of the passage from Buffalo to New York will be from seventeen to nineteen dollars,—the former sum allowing for a deduction by the competition of the North river steamboats. As the track on the northern line consists of the light plate bar, the speed cannot exceed fifteen miles per hour; and the time occupied, including the unavoidable detentions resulting from so many different proprietorships, the ferry at Albany, etc., cannot be less than thirty-six hours. The New York and Erie railroad, therefore, at the first commencement of its operations, may very well be able to offer to passengers from lake Erie and the western States, the inducement of a saving of $5 in expense, and twelve hours in time.

The following statements, which exhibit in a very striking manner the rapid increase of the trade of the upper lakes, are extracted from a late report of Lieut. Col. Kearney, *of the United States Topographical Engineers.*

"In the year 1825, there was but one steamboat, of 350 tons bur-

den, and thirty or forty small craft on the American side of the upper lakes, and the tonnage was, in all, somewhere about 2,500 tons. In the year 1830, the registered and enrolled tonnage was yet but 3,497 tons, and the canals which connect the trade with the St. Lawrence and with the Hudson, had been completed.

"In 1831, when the works on lake Erie had begun to afford some protection to vessels, the tonnage employed upon it had nearly doubled that of the preceding year. There were now eleven steamboats and one hundred other vessels, the aggregate tonnage of all amounting to 6,532 tons.

"In 1832, the Ohio canal, connecting the lake trade with the valley of the Mississippi, was completed. The aggregate licensed and enrolled tonnage, according to the treasury statements, (we have no other account of the shipping for that year,) was 8,552 tons. During this and the succeeding year, the harbours, as already stated, were becoming at all times accessible to the largest class of vessels, and in the latter year (1833) this accessibility was effected. In that year the aggregate tonnage was 10,471 tons. Since that time it has continued to be steadily progressive to the present period. We have more precise accounts of it for the years 1836, 1837, 1838 and 1839, and we insert here the aggregate tonnage for these four years, distinguishing between that of steamboats and rigged vessels:—

"In 1836, there were 45 steamboats, (9,017 tons,) and 211 vessels, (15,030 tons) in all, 24,047 tons.

In 1837, there were 50 steamboats, (10,509 tons,) and 230 vessels, (16,934 tons,) in all, 27,443 tons.

"In 1838, there were 52 steamboats, (17,429 tons,) and 234 vessels, (16,848 tons,) in all, 34,277 tons.

"In 1839, there were 61 steamboats, (17,324 tons,) and 225 vessels, (17,799 tons,) in all, 35,123 tons.

"The value of the shipping of all classes in the year 1839, is $2,400,600, and they furnish employment for two or three thousand persons. In the year 1836, it was estimated that the capital invested in steamboats was $1,000,000. In the year 1839, the cost of steamboats is estimated at $1,741,200. In the year 1837, it was estimated that, taking into view the average number of trips made by each class of vessels, the trade per month, during the business season, amounted to 75,898 tons. Following this rule, and applying it to the year 1839, we would have about one hundred thousand tons as the monthly business."

(Note C.) *Description of the manner in which it is proposed to construct the track of the New York and Erie railroad, on those portions not already laid. The part between Goshen and Piermont has been made on the same principles, with some modification of the details.*

The iron rails are of the H form, with heavy heads. They are three and a half inches high, four inches wide on the base, and weigh fifty-six pounds per lineal yard. Both sides are alike, in order to ad-

mit of reversion, if symptoms of failure are perceived in those parts exposed to the action of the wheels.

The rails are to be supported on continuous bearings of timber, twelve inches broad, eight inches thick, and as long as can be conveniently obtained. They must be scarphed at the ends, so that no irregular elevation or depression of either stick can take place at a joint. They will break joints with each other, and with the iron rails; and will be bound together, at every six feet on curves, and at every eight feet on tangents, by cross ties of plank, seven and a half feet long, three inches thick, and seven inches wide, fitted accurately into notches two and a half inches deep, on the upper side of the longitudinal timbers, and secured by a treenail, or pin of oak, two inches in diameter. The position of the base of the rail having been then accurately marked out on the cross ties, notches half an inch deep and four inches wide will be cut in them, so as to let the rail rest continuously on the longitudinal timbers, the edges of which must be addiced down to shed the rain.

The rails are secured from any motion, except that due to the expansion and contraction of the metal, by appropriate chairs of cast iron at the joints; and are fastened to the timbers by brad headed spikes, half an inch square and five and a half inches long, one of which is required for every eighteen inches.

Where timber of suitable quality is found on the line of the road, it may be hewn on two sides instead of being sawed square. In such cases it must be got out nine inches thick, and counter hewn on the upper surface before being laid.

It will be noticed that by this plan of road, each bearing timber rests continuously on the ground, and at the same time supports continuously the iron rail. The cross ties too, have a double action; binding together the longitudinal bearers, and also connecting the rails, by the notches into which their bases are fitted. By placing the ties on the upper side of the bearers instead of the lower, the connexion is made at the point where its efficiency is greatest and most necessary, and as no part of the vertical support is derived from the ties, the dimensions proposed for them will be found sufficient.

The drainage of the track will be effected by a ditch between the longitudinal timbers, for which the width between the rails affords ample room; and cross drains at suitable distances will carry off the water. The centre drain, will be sunk lower than the cross ties, so as not to interfere with them.

The following extract from an English writer, Mr. John Reynolds, explains very satisfactorily the disadvantages of the ordinary modes of constructing railways, and accounts, in some measure, for the great weight which the latest patterns of British rails exhibit.

"The principle of continuous bearings, avoids the chief obstacle to durability, which pertains to the plan of supports at intervals, whether they be blocks or sleepers, viz. the alternation of *flexible spaces* and *rigid points*, which, (even if the supports maintain an exact level,) produces in carriages moving rapidly over them, a series of concussions, as the wheels successively impinge on the rigid or sup-

ported parts of the rails. Also, however small may be the deflexion of the rail between its points of support, those points become fulcra, on which it acts as a lever, to raise or shake the supports next beyond them. When the supports assume irregular heights, (which is the usual case,) not only are the above evils greatly aggravated, but the rail acts upon every support as a spring beam, tending to jerk it up, or loosen its fastenings."

Where a *piled road* is adopted, (which will be the case on more than two hundred miles of the Susquehanna and Western Divisions,) a similar superstructure is proposed, with the necessary modifications for connecting it firmly and securely to the heads of the piles.

The *width of track* on the New York and Erie rail road is six feet, and the distance between the tracks (where two lines are laid,) is seven feet. These dimensions admit of wider and more commodious cars being used with safety, than can be adopted for roads of the ordinary width. The first class passenger cars already built for this road, are believed to be equal to any hitherto constructed in the United States, with regard to beauty and finish, and superior in all the arrangements and appliances requisite for comfort and ease. They are eleven feet wide, and thirty-six feet long, and are mounted on eight wheels. Those intended for gentlemen, will accommodate, comfortably, seventy-eight persons. The ladies' cars have drawing and retiring rooms of ample dimensions.

The second class cars, intended for the use of emigrants, and others desirous of traveling at a low rate, and willing to accept of cheaper accommodations, will be capable of carrying one hundred persons.

[TO BE CONTINUED.]

Bibliographical Notice.

Notice of a description and catalogue of the Derby Arboretum. By J. C. LOUDEN, F. L. S., &c. &c.

A garden comprising eleven acres of ground, beautifully laid out and embellished with upwards of a thousand different varieties of plants and trees, has lately been presented to the inhabitants of Derby, England, by one of their citizens, Joseph Strutt, Esq., as a place for public recreation. The admirable design of this garden, both for physical and intellectual enjoyment, as well as for general improvement in the interesting science of botany, is worthy of particular remark, and may afford useful hints in the laying out of Public Grounds in any country.

It consists of a collection of such trees and shrubs, foreign and indigenous as will endure the open air in the climate of Derby, with the names placed on each.—The author of the plan, J. C. Louden, Esq., observes, in reference to it, "that such a collection has all the beauties of a pleasure ground viewed as a whole; and yet, from no tree or

shrub occurring twice in the whole collection, and from the name of every tree and shrub being placed against it, an inducement is held out for those who walk in the garden to take an interest in the name and history of each species, its uses in this country and in other countries, its appearances at different seasons of the year, and the various associations connected with it."

In order to excite an interest in the subject, visitors are supplied with printed catalogues containing the names of the plants, their habits, native localities, &c. "The order in which they are arranged," continues Mr. Louden, "is what is called the *natural method*, by which plants are classed or grouped according to the greatest number of points in which they resemble one another. The largest groups form classes, the next largest orders, and these are subdivided into tribes, genera, species, and varieties. This mode of bringing plants together in groups greatly assists, not only the memory, but the judgment; for, if we recollect any one plant in a group, and its properties, we may conclude that all the others belonging to it bear the same general resemblance externally, and contain, more or less, the same internal properties. This any visiter of the garden may convince himself of by looking at all the plants enumerated under any one order, and comparing them with one another; and this he may do at any season of the year, though to the greatest advantage when the plant is in flower."

The gravel walks in the garden measure upwards of a mile in length and are ornamented with pedestals, vases, seats for three hundred and fifty persons, beautiful pavilions in the style of James the first, and lodges in the Tudor and Elizabethan style.

The plan of the Arboretum emanated from the highly cultivated mind of Mr. Louden, its execution was attended to by him in person, assisted by Mr. Rauch, and the architectural designs for the pavilions and lodges are by Mr. Lamb, of London. The best talent of the country has thus been brought into requisition by Mr. Strutt to give value and elegance to his gift.

Instances of *living* munificence on so grand a scale as this are seldom to be found. Men frequently *leave* their accumulations of wealth to public objects, and give, for noble purposes, treasures they can no longer enjoy nor take with them; but however praiseworthy such posthumous generosity may be, it bears no comparison with the liberality of the man who shares his fortune with a whole community during his life-time, and thus deprives himself of what he might probably live long to enjoy.

A pamphlet containing a description of the Arboretum, a catalogue of the trees and plants, and an account of the ceremonies of opening

it to the public, has been received from the author, and is placed in the Library of the Institute. T. U. W.

Mechanics' Register.

LIST OF AMERICAN PATENTS WHICH ISSUED IN MARCH, 1840.

With Remarks and Exemplifications by the Editor.

1. For an improved machine for *Pressing Palm-leaf Hats;* Chester Gorham, Barre, Massachusetts, March 3.

In this machine the hat to be pressed is placed on a block attached to the upper end of a vertical shaft, the lower gudgeon, or pivot, of which rests on a sliding step provided with a weighted lever for the purpose of forcing the crown and rim of the hat against the irons. The irons, or, as they are termed, "boxes," in which the heaters are placed, are attached to a sliding frame provided with a lever to enable the operator to apply them to the hat and draw them off. One of the "boxes" is attached to each side of the frame for the rim, a third is attached by gudgeons to the back, for the crown, and the fourth slides in a vertical frame rising from the first mentioned frame, to press the top of the crown, and is furnished with a screw to regulate its distance from those that press the rim. The weighted lever is provided with a catch to relieve the pressure. The claim is confined to the combination of the boxes that press the rim and crown attached to the first mentioned frame, the box that presses the top of the crown regulated by a screw, and the shaft to which the hat block is attached. Some practical difficulties present themselves in the carrying out of the alleged improvements, as for instance, the irons which press the rim are both attached unyieldingly to the sliding frame, hence they cannot accommodate themselves to the inequalities of the hat—so of the pressure applied to the top of the crown, the distance between the top and the two rim irons, is regulated by a screw, which when set will not yield to inequalities. These difficulties do not exist in the machine previously known, in which the irons are attached by a universal joint to a lever, and the pressure applied to the hat by the operator's hands.

2. For an improvement in the manner of constructing *Bedsteads;* John Hart, Lebanon, Kentucky, March 3.

This improvement consists simply in extending the shoulder of the rail, which fits against the post, considerably beyond the periphery of the rail so as to render the posts more steady. "What I claim as my invention and desire to secure by letters patent, is the extension of the shoulder beyond the periphery of the rail in the manner and for the purpose specified."

3. For improvements in *Fire Escapes;* Sylvester Pentfield, Hartford, Connecticut, March 3.

This fire escape consists of a vertical shaft, rising from a pedestal of peculiar construction, on which slides a platform which can be moved up and down by the persons on it by means of a pinion mashing into a rack on the shaft. The platform is provided with a railing except on the side to be presented to the fire where it is provided with polished plates of metal which slide in grooves, to serve as a protection against the flames. The pedestal is formed of four bars called "arms," each of which is jointed to the lower end of the shaft, thus forming a cross. There are four diagonal braces hinged or jointed to the shaft, the lower end united to the outer end of the "arms," by attaching the end of each brace to a "block," which slides in a "mortice in each arm," and regulated by a screw. It will thus be seen that the shaft can be maintained in a vertical position without reference to the inequalities of the ground. The outer end of each arm is provided with a truck roller to facilitate the moving of the machine.

The claims are, "1st, combining with the movable platform, plates of polished metal, or of wood and metal combined, the said plates sliding in grooves at the back of the platform. And 2nd, the mode of keeping the shaft in a vertical position, so as to adapt it to any inequality of soil by means of the following combined arrangements, viz. the arms hinged to the shaft so as to admit of their being raised or lowered, in combination with the braces attached to the block moving in a mortise in the aforesaid arms, and regulated by means of a screw."

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4. For an improvement in *Dry Docks;* Charles F. Johnson, Tioga, New York, March 6.

This dock operates on the principle of those which raise the vessel by having inverted boxes under the cradle, into which air is introduced to exclude the water, and the patent is granted for a mode of preserving the equilibrium of the cradle and prevent rocking, which is effected either by means of vertical screws attached to each side of the cradle and passing through nuts on each side of the dock, or by racks with ratchets into which palls work, or by ropes passing around pullies attached to the sides of the cradle and dock.

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5. For an improvement in the *Door Latch;* Benjamin M. Bosworth, Warren, Rhode Island, March 6.

This improvement consists in the manner of working the latch by means of a rod of iron which passes through a vertical slot in the door, and which is provided with a knob on each side; when the rod is lifted up, it comes in contact with the inner end of the latch, which it lifts, and thus depresses the outer end, and disengages it from the hasp —the latch being the reverse of the common latch in its operation. The claim is confined to the mode of disengaging the latch by raising the rod and knobs vertically in the slot.

6. For an improvement in the *Knob Latch* for doors, &c.; Lewis and Willis Hotchkiss, Derby, Connecticut, March 6.

This improvement is applicable to the lifting and to the sliding latch, and consists simply in dispensing with the "lever," or "cam," usually employed on the bar to give motion to the latch, and effecting the same thing by cutting a notch in that part of the bar which comes in contact with the lever little less than one-half of its diameter, leaving a flat face which forms the cam. The amount of motion to be given to the latch will depend upon the diameter of the bar and the depth of the notch, which should not be more than the semi-diameter of the bar. The claim is confined to this device.

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7. For an improvement in the machine for *Mixing and conveying Clay for Making Bricks;* James Hodge, Fairplay, South Carolina, March 6.

A large threaded screw revolves in a trough for the purpose of mixing and conveying the clay to the moulding machine. At one end of the trunk there is a hopper in which work two pounders by means of tappets on a shaft, for the purpose of breaking the large lumps of clay, and forcing it into the threads of the screw, and at the opposite end of the trunk the clay is discharged into the moulds and pressed. The claim is confined to the pounders, or rams, in combination with the screw for mixing and conveying clay.

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8. For a *Machine for Colouring Maps, Charts, or other Prints;* Lucius Stebbins, Hartford, Connecticut, March 12.

The map or print is attached to a table so that it shall not move during the operation of colouring. A plate revolves upon a pin, or axis, attached to the same table, and to its outer edge are secured, in succession, a series of thin metal plates with holes through them corresponding with the boundaries of countries, &c., which are to be differently coloured. These plates are in succession applied to the surface of the map, &c., and the colour applied as in the process of painting with theorems. The patentee says, "I do not claim the invention of colouring through patterns or theorems as they are sometimes called; but I do claim as my invention and desire to secure by letters patent, attaching the patterns to a plate revolving on a fixed centre, as herein set forth, and the combination of the revolving plate with the table on which the map is placed, the whole constructed and operating as above described."

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9. For an improvement in *Trusses for Hernia, &c.;* Enoch Thomas, New Athens, Ohio, March 12.

This truss consists of an elastic belt passing around the body, to which the hernial, sacrum, and ilium pads are attached. From the sacrum pad two straps descend to the perineal pad, and from it the round straps pass and are connected to the front or hernial pads. Two pads, called femoral pads, one of which is straped around each

thigh, and connected to the belt by means of two straps attached to each and buckled on to the ilium and front pads. The patentee says, "this new and useful improvement is especially designed and perfectly adopted to cases of inguinal hernia, either in the male or female, and is so constructed as to prevent, during its application, any protrusion of the intestines through the inguinal ring. It is also perfectly adopted to cases of prolapsus uteri in females. What I claim in the elastic and spring supporter as my invention, is the simple combination of the thigh straps for retaining the belt in situ with the belt, constructed and operating as above described."

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10. For an improved mode of *Constructing Cars for Railroads and guiding them thereon;* Isaac Newton Stanley, Philadelphia, Pennsylvania, March 12.

It would be useless to attempt to give, without drawings, more than a general idea of the construction of the cars by which they are made to follow the curvature of the road and to run in and out without the aid of switches or any attendance. The improved construction is adapted to the eight wheeled cars now in general use, but instead of having the two axles of each truck in one frame, each axle is in a separate frame, and two of these frames are united together to constitute a truck, so that each axle can be thrown into the radii of the curvature, and the two trucks are so connected that when the axles in one truck assume the direction of the radii, those in the other truck are compelled to do the same. Instead of placing the outer rail of a curve upon a higher level than the inner one, to prevent the centrifugal force from throwing off the cars, this object is attained by a contrivance which gives to the body of the car an inclination inwards the moment the first truck runs upon a curve and assumes the line of the radii.

A guide rail is employed to prevent the cars from running off the track in short curves, and to compel them to follow any given track by having a roller connected with the car, and acted upon by the guide rail in a manner which could not be clearly explained without drawings. The patentee concludes by saying "I claim the manner in which I construct and combine the two four wheeled trucks as above set forth, by which the axles are made simultaneously to conform themselves to the radii of the curvature of the track; that is to say, the manner in which I connect the parts which I have denominated the hounds, with the respective frames of the trucks, and with the general frame or car bed, so that the two studs, or slides, which work in the slotted metallic plates, and the two transoms, or king bolts, always standing in a right line shall compel the respective angles to conform themselves to the curvature of the road by an arrangement of parts substantially as above set forth. I claim the manner of causing the load to incline over towards the inner rail of a curve by means of the projections below the bolster operated upon by the hounds, or by any analogous arrangement, as described. I claim the manner of compelling the locomotive or carriage to keep the proper

track by the aid of guard or guide rails constructed and located as herein described, and operating upon a guard or guide apparatus substantially with that herein made known, for the purpose of dispensing with switches and other analogous devices, and rendering the passing of the train, upon the proper track, independent of the engineer or conductor thereof. I also claim the use of the guard rail and guard apparatus for preventing the running of the carriage from the track, as described."

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11. For an improvement in the *Anvil for Heading Spikes;* Wm. Thomas, Hingham, Massachusetts, March 14.

A square hole is made vertically into the anvil for the reception of a block and tube of steel, the former resting upon the bottom of the hole in the anvil and the latter upon it. The hole in the tube is to receive the spike to be headed, and at the bottom there is a lateral groove which communicates with a groove running along the side of the block from top to bottom, for the purpose of discharging the oxides formed through a lateral opening in the side of the anvil. The usual heading tool is used. The claim is to "the making of an anvil with the openings at the top and side to receive the block and tube and for the escape of the oxides."

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12. For a mode of *Laying Veneers;* Casper Kittenger, Massilon, Ohio, March 14.

A board of any given length and width, to be governed by the size of the article to be veneered, passes through mortices made in two pieces of hard wood, one placed at each end. A mortice or slot is made in each of these pieces of wood, parallel with the one through which the board passes, to receive two rods of iron having a screw and nut on each end, to prevent them from falling out of the slot, but not screwed tight enough to prevent them from sliding along the length of the slots. To these rods is attached a band or sheet of iron, leather or cloth, reaching nearly the whole length, and hanging loose from one to the other, so as to form about a half cylinder. The board is provided with any given number of band screws, which pass through it and act upon the back of the article veneered, thus forcing the veneered surface against the band which adapts itself to the form of said surface. The claim is to the combination of the screws and bands, as described.

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13. For a *Cooking Range;* Herbert H. Stimpson, Boston, Massachusetts, March 14.

This range is provided with two side flues, built in the masonry, and inclining inwards until they unite with the main flue above the mantle; at the bottom they are immediately back of the side boiler holes, so that the draft can be carried from each side of the fire-place under the side boilers. The range is also provided with a hollow column on each side, and these are united at top by a hollow mantel. The main improvement consists in a particular arrangement of damp-

ers and flues, by which the draft can be carried either directly into the side flues in the masonry, or up the front half of the side columns, and thence along the front to about the middle of the mantel, the draft is then returned along the back of the mantel, and down the rear half of the columns into the side flues. For this purpose, the mantel is divided by a partition across the middle, and by two plates running from each end to near the middle, into two double flues, and each column is also divided by a partition plate into a front and back flue. The damper consists of a plate which slides under the bottom of the column, (one for each,) and to the bottom of it is attached another plate at right angles with it, so that they move together, and thus enable the attendant to give the proper direction to the draft. If it is desired to heat the apartment, the draft is carried through the columns and mantel, and then into the side flues, but if the heat is wanted for cooking only, it is then carried directly into the side flues. The claim is confined to the construction of the dampers, as described, and to their combination with the side flues in the masonry, and with the double flues in the columns and mantel.

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14. For a machine for *Breaking Dough;* John W. Post, Baltimore, Maryland, March 14.

This is alleged to be an improvement on the old machine for breaking dough, by means of two cylinders, through which the dough is rolled; the improvement consists in the method of returning the dough to the cylinders to be again rolled, instead of replacing it by hand, as in the old way. One of the cylinders, and that the upper one, if they are placed one above the other, is nearly surrounded by small rollers revolving in a direction the reverse of that of the cylinder. The space between the cylinder and the rollers is equal to that between the cylinders, so that the dough is carried up by them and presented again to the cylinder to be re-rolled. There are knives or scrapers placed between the rollers to prevent the dough from being carried between them. The patentee says that the same thing can be effected by means of a belt and one roller, and a weighted tightening pulley to yield when the dough passes between the cylinder and the belt. The claim is to the "manner of carrying up the dough after it has passed through between the breaking cylinders, by means of the elevating rollers, or by means of the rollers and belts united, to feed the breaking cylinders."

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15. For an improved *Sluice Gate for Canal Locks,* and which is applicable to other purposes; George W. Hildreth, Lockport, N. Y., March 19.

The claim upon which this patent has been granted, will give as distinct an idea of the principle of this improvement as could be given in a short description of it without drawings—it is in the following words, viz. "What I claim as my invention, and desire to secure by letters patent is, "1st. The making of the gate in the segment of a cylinder revolving on a pivot at each end, and fitting against concen-

tric plates attached to the frame in which the gate moves, as herein described." 2nd. "I claim the placing of the pivots of the segment gate below the centre of the circle, (of which the segment gate is a part,) so that in closing the gate a close joint shall be formed, and by the same means a greater pressure of water is brought upon the gate above the pivots than below, which assists in opening the gate, as described." 3rd. "I also claim as a substitute for the preceding, the placing the pivots of the segment gate in the centre, and placing the plates against which the gate slides, a little eccentric thereto, for the same purpose."

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16. For improvements in the *Floating Dry Dock* for raising vessels; Joseph T. Martin, New York, March 19.

This is an improvement on that kind of floating dock described in the 14th vol. of this journal, page 252, and in the 22nd vol., page 239, December 20, 1837. The ends of the main trunks, or floats, have appended to them separate hollow floats, which slide up and down, in frames constructed for that purpose, in the ends of the trunks, and they are retained in their position by racks and palls, and provided with pumps to let in or take out water. The sections of the dock, or the trunks, are united together by beams passing through slides, which are governed by a series of levers, in such a manner as that the dock can be shortened or lengthened whilst under water, by removing the trunks farther apart, or drawing them closer together. In the trunks there are water cisterns provided with pumps, and these are united by pipes with the body of the trunk, so that if desired, any water which may have leaked into them, may be pumped out by the pumps used to discharge the water from the cisterns. The claim is in the following words, viz. "I do not claim as my invention the formation of a floating dry dock by the union of sections or floating platforms, nor do I claim as my invention the construction and use of end floats, or any of the separate parts of the above described floating dry dock. But the end floats heretofore in use, have had no machinery attached to them by which they might be filled with water when necessary, for the purpose of causing to sink, or aiding to sink, the floating dock, and have, in fact, been so constructed with the intention that no water should ever be admitted within them, and therefore I do claim as my invention the new and useful improvement herein before fully described, or any other method substantially the same, by which they are filled with water and emptied of the same, for the purpose herein set forth. In combination with this I do claim the application of racks and palls for securing the position of the end floats, as herein set forth. I do also claim the above described combination of machinery by which the dock is lengthened or shortened whilst the dock is under water. And moreover, I do claim the application of the cisterns within the main floats, ("or trunks,") with their appendages, in combination with the reservoirs whereby the same pumps that are used for filling the reservoirs, may pump out the leakage of the main floats."

17. For an improvement in the mode of *Packing Rotary Steam Engines;* John D. Akin, Columbus, Pennsylvania, March 19.

This improvement is only for the packing of those parts which present two or three faces. The part to be packed is provided with a groove, into which the metallic packing is fitted. This packing consists of two metallic plates put together by halving the pieces where they meet, in the manner of a square shouldered splice, and two screws, with conical ends, are employed to spread and force out the two halves, the conical end of each screw passing in between the end of one piece and the shoulder of the other; so that as the screws are advanced the packing will be forced out and spread endwise. This kind of packing is described as applied to the steam heads and sliding valves of a rotary steam engine. The claim is to the mode of packing "by means of the countersink, halved plates, and conical screws."

Perhaps this may prove to be an improvement in the manner of packing, and so far so good, but the difficulties in the action of the rotary steam engine will be but very partially removed by an improvement in the manner of packing only.

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18. For an improvement in the *Cooking Stove*, designed for burning coal; Reuben Jackson, Zanesville, Ohio, March 19.

This stove is provided with two fire chambers, one at each end, there being a separate flue and outlet into the chimney from each; the oven is placed between the two fire chambers. The bottom of each grate is below the bottom of the oven; one grate being lower than the other. The draught from the highest grate passes up along one end, over the top of the oven, and out at the side; and up from the other grate, over a plate which separates the grate from the oven plate, down the back, along the bottom, and out at the side into the chimney. The claim is to the arrangement of the oven between the two fire-places, so as to carry the draught in the manner described.

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19. For an improvement in the manner of covering *Spring Saddles;* Orren M'Cluer, Fredonia, New York, March 25.

The leather of the saddle seat, instead of being attached to the head of the tree, is attached to a spring which is fixed to the head of the tree, or to the straining web, which connects the spring and the back of the saddle. The skirts of the saddle lap over the covering of the seat sufficiently to allow the play of the spring, without allowing the edge of the covering of the seat to be drawn from under them. This arrangement allows full play to the spring without straining the covering of the seat. The claim is confined to this mode of constructing, or covering, saddles.

20. For a mode of *Stretching Cloth in the process of Fulling;* B. D. Whitney, and G. W. Lawton, Winchendon, Massachusetts, March 25.

The cloth is carried around a series of rollers, one of which has its surface cut into a right and left-handed screw, each commencing in the middle and running out to the end. As this roller or double screw revolves with the cloth drawn over it, it will stretch the cloth widthwise. The same object is more effectually attained by making the surface of the roller in sections, sliding from the middle towards each end; the surface being seared or grooved so as to take hold of the cloth. The sections or segments project at each end beyond the body of the roller, and the part which projects is provided with a roller which fits into a spiral groove in a stationary cylindrical block at each end, and the grooves are so arranged that as the segments move around when they come to that part of their circuit in which they meet the cloth, (which is only in contact with a portion of the circumference,) the segments move outwards, stretching the cloth from the middle towards each edge, and when they leave the cloth they are drawn in. The claim is in the following words, viz. "We claim stretching the cloth widthwise during the process of fulling, or after it is fulled and steamed, by means of the right and left threaded screws, or fluted segments, in manner as above described."

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21. For an improvement in *Grist Mills;* Edward Gray, Ulysses, New York, March 25.

This improvement consists in placing a pair of small stones in the eye of the runner to prepare the grain before it passes to the large stones. The under one of the two small stones rests upon the driver of the large runner, and revolves with it, and the upper one is driven in the opposite direction by a driver attached to a small shaft, which takes the place of the damsel; its lower gudgeon working in the upper end of the main spindle. The grain is fed into the eye of the small upper stone, and after being partially ground, passes to the large stones to be ground into flour or meal. The defects in the common grist mill, which the patentee says he has overcome, are, "1st. The slowness of the grinding performed around the eye of the common stones, owing to the slow movement of the runner at this part of it, and the consequent insufficient supply of prepared grain for flouring, or being ground into flour, which is accomplished by the surfaces of the stones near the circumferences thereof, where the movement is quicker. And 2nd, the introduction of too much cool air between the stones through the eye of the runner."

The claim is confined to the introduction of the small stones in the eye of the runner. Whether the alleged defects in the old mode are real; and whether, if they are so, they will be remedied by the proposed arrangement, are questions to be decided by the experience of the miller.

22. For improvements in the *Floating Dry Dock;* John Gilbert, city of New York, March 25.

This floating dock is provided with a double sliding gate at one end, through which the vessel enters, and the inside with a boat gate, which can be shifted along lengthwise of the dock, for the purpose of reducing its capacity for receiving vessels of different tonnage. The space between the outer sides of the dock and the inclined partitions or inside walls, is occupied by water-tight tanks, (or rather these spaces are divided by water-tight partitions or bulk heads,) connected with each other, and with a pump well, by means of pipes, governed by cocks or valves, for the purpose of filling them with, or emptying them of, water. On each side of the dock there is a platform running its whole length, on its outside, which is provided with railways and loaded cars, connected with a windlass, by means of chains, for the purpose of trimming the dock. There is a mode of framing or putting the timbers together, which is described, but which cannot be clearly explained in our narrow limits without a drawing. The claims are first to "the employment of a boat gate, in the manner described, for the purpose of dividing the machine into two compartments, in the manner and for the purpose described." "Secondly, the manner of employing movable loaded, or ballast, cars, which are made to run upon suitable rails, or ways, situated on the platform, extended out for that purpose, in order to regulate the centre of gravity of the apparatus, as described." "Thirdly, the particular manner of uniting or putting together the timbers of uniform size, for the construction of the platform and of the sides of the dock, which saves the expense of building stages, as set forth."

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23. For an improvement in *Breast and Pitch Back Water Wheels;* Edward Robbins, Jr., and William Ashby, Bordentown, Burlington county, New Jersey, March 25.

This improvement is designed to admit of the escape of the air which remains in the buckets after they have received the water from the flume, and allowing it to escape through openings in the sole or lining of the wheel, as the buckets, in their descent, are being immersed in the back, or tail race water. The buckets are either radial, or inclined to the radii, and do not reach the sole or lining of the wheel, but leave an open space between the two, which is closed by a flap either hinged to the back of the bucket, or turning on pivots in the shrouding, so as to operate as valves or shutters, the back or inner edge closing against the sole or inner lining directly above the hole made through it for the escape of the air in the bucket below. As the bucket descends, the back of the flap comes in contact with the water in the tail race, which opens it, and passes into the bucket following, forcing the air contained in the bucket above the water, out through the hole in the sole or lining. Were it not for this arrangement, the patentee says the "air would be carried down, and be forced to descend with the buckets through the back water. This carrying down of the air, it must be manifest, would offer a considerable re-

sistance to the motion of the wheel, and that it does so, is well known to us from the most satisfactory experiments which we have made. Having thus fully described the manner in which we construct our improved water wheel, and shown how the same operates, we do hereby declare that we do not claim, as of our invention, the application of valves to buckets, as we are aware that such application had been made prior to our use thereof, but in a way very different from that in which we have made it, and not effecting the same object, namely, the allowing of the free escape of air, and the free admission of water into the buckets, as they dip into the tail race, or back water, and thus preventing the carrying down of the air through said water. What we claim, therefore, as of our invention and desire to secure by letters patent, is the employment of valves in buckets of water wheels, such valves having the position herein described, and being used in combination with the openings through the soling of the wheel, that is to say, said valves forming an angle of 130°, more or less, with the radiating buckets, or with radii of the wheel, and closing against its soling immediately above the opening, for the escape of air."

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24. For an improved mode of constructing *Bedsteads;* Mahlon Gregg, Philadelphia, Pennsylvania, March 25.

This patent is taken for a mode of fastening the rails to the posts, and for tightening the sacking. The tenon on the end of the rail is conical, the smaller end being towards the rail, and they are turned of the solid material. On two opposite sides the conical part is cut off. The mortise in the post being made the reverse of the tenon, it will be evident that it will admit the tenon when presented in one direction and when turned will retain it. The mortise is so formed as to draw the joint tight by turning the rail inwards.

The sacking is attached to a frame inside of the rails, which frame is connected with them. Pins project from the inside of the rails on to which the pieces forming the inner frame slide; those on the side rails are provided with screws and nuts, or with slots and wedges, for the purpose of drawing the sides of the frames towards the rails. The end pieces of the inner frame are formed with inclined planes at each end, against which the ends of the side pieces rest, so that as the side pieces are drawn out, their ends being in contact with the inclined planes of the end pieces, will force them out also, and thus stretch the sacking in all directions. The claim is to this mode of forming the joints of bedsteads, and to the manner of attaching and tightening the sacking.

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25. For an improvement in *Ploughs;* William Bryant, Davidson county, Tennessee, March 31.

This improvement consists simply in attaching, behind the share or cutting part of the plough, a coulter, in such manner as that it shall enter and loosen the ground deeper than it is cut by the share. This coulter is attached to the beam which is extended farther back than usual. The claim is confined to this device.

26. For improvements in *Candlesticks;* William Church, a citizen of the United States, residing at Birmingham, in the county of Warwick, England, issued 31st of March, and patent to run 14 years from the 14th of June, 1838, the date of the English patent.

This patent was granted for a mode of holding the candle in the socket of a candlestick by means of springs arranged in the socket. There are various kinds of springs described and represented, the simplest of which is composed of a series of spring tongues arranged around the socket and attached at the bottom of it. The patentee says, "I desire it to be understood that I claim as my improvement in candlesticks, an elastic holder for the candle, connected to the socket by whatever means and however formed."

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27. For an improvement in *Soap Frames* employed in the manufacture of soap; Joseph Bolton Doe, London, England, issued March 31st, and patent to run 14 years from the 14th of June, 1838, the date of the English patent.

This is an improvement on the well known wooden frames. The improved frames are made of iron or other metal, or compounds of metals, and consist of a bottom plate placed on rollers, to facilitate removal, with the two side plates hinged to it—one end plate being cast with or bolted to each of the side plates, so that by letting down the two sides the ends are also opened, which leaves the cake or block of soap standing on the bottom plate to be cut into bars. After the block has been removed the sides are thrown up, and where the end plate attached to one side meets the other side plate the two are bolted together. The patentee says, "what I claim as constituting my improvement in soap frames is the constructing of such frames from metal or other material which is a good conductor of heat, in the manner herein described; that is to say, by making them in one entire frame, (in lieu of in separate frames placed over each other,) and having movable sides and ends secured together by bolts or other analogous devices, substantially as herein described."

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28. For a machine for *Removing Snow from Railroads;* Charles Lowbaert, Philadelphia, Pennsylvania, issued March 31st, antidated January 15th, 1840.

A platform is placed on the frame of a car above the wheels, and extending some distance beyond the sides of the car frame, to the forward end of which is attached an inclined plane descending to the rails of the road on which it rests, it being properly shod for that purpose. The vertical sides of this platform, which descends to the level of the rails, extend beyond the end of the inclined plane so as to cut the snow before the inclined plane begins to raise it. On the top of the platform there is a triangular frame with one of its angles placed in the middle of the junction of the inclined plane and platform, so as to have two of its sides run out beyond the sides of the platform, to divide the snow which is carried up the inclined plane and discharged

by it on each side. For the purpose of dividing the snow, which is carried up, unequally, should it be desired to discharge more on one side than the other, a board or cutter is hinged to the angle of the frame on the platform and runs out as far as the ends of the sides of the platform, its lower edge resting upon the inclined plane, so as to cut the snow which goes up the plane in unequal parts. This machine is pushed forwards into the snow by the locomotive. "What I claim as my invention," says the patentee, "and desire to secure by letters patent, is the method of dividing and removing snow on railroad tracks, &c., by means of an inclined plane constructed with sides as herein set forth; and of conducting the same from the machine by means of the raised platform, triangular frame, and wings, in combination with the foregoing arrangement, the whole being constructed and operating as described."

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29. For an improvement in the *Rocking Chair;* Samuel H. Bean, Philadelphia, Pennsylvania, March 31.

Instead of having the rockers placed at the bottom of the legs, they are attached to the bottom of the seat, and rock on a frame at the top of the legs. To prevent the seat from being thrown off the stool, there are two metal plates hinged to each rocker by a pin, to give them free play in the direction of the rockers, and passing through mortises in the rails on which the rockers play; they have a shoulder at the lower end which strikes against the under side of the rails should the seat rock too far. The front plate of each set is provided with notches, into which a catch can be driven to prevent the seat from rocking if desired. The patentee claims, as his invention, the "making the seat and stool of the chair in two parts, so that the seat shall rock on the top of the stool, instead of having the parts permanently united, with rockers on the legs of the stool as heretofore; and also the mode of connecting together the seat and stool by the vertical plates attached to the seat passing through the stool with shoulders projecting from the sides thereof which catch against the under side of the stool when the seat is rocked to and fro; and likewise the manner of reclining the seat at any angle required by the lock plates and catches in the hanging plates which receive them, as before described."

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30. For an improved mode of *Preparing Flax and Hemp* before cleaning and separating the fibres; Sands Olcott, New Hope, Pennsylvania, March 31.

The flax or hemp, rotted or not rotted, that has been partially broken is to be converted into an *endless rove or belt.* This may be done by spreading it upon a table, and twisting it so that it will hold firmly, and then splicing the two ends together.

The patentee says, "the advantages of this process are of all the others." "1st. It is more easily and *continually* subjected to the action of the machinery, that will separate the wood and split the fibres." "2nd. It is more easily handled and dried." "3rd. The fibres are kept straight and clear amid the process, and cause less

waste." "What I claim as new, and as my invention, is the shape in which I place the material to be worked, or in other words, the convertion of hemp or flax to be acted on into an *endless rove or belt*, so that it may continue to pass in and out of the machinery, after the manner of a belt."

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31. For an improved mode of constructing *Bales and Drivers for Grain Mills;* Ezra R. Benton, Ohio City, Cuyhoga county, Ohio, March 31.

The claim appended to the specification of this patent gives as clear an idea of the construction as could be given without a drawing; it is in the following words—the letters of reference contained in the original being omitted, viz. "What I claim as my invention, and desire to secure by letters patent, is the connecting of the *bale* and *driver* with corresponding prongs and depressions, constituting a three or two bearing coupling, said couplings being on a level, or nearly so, with a hemispherical depression in the centre of the bale, thus coupling the *bale* and *driver* together, at, or nearly at, the same distance from the face of the stone with the point of the spindle on which the stone is suspended and balanced, in the manner set forth." "I also claim giving the rounding or head form to the sides of the square of the spindle, for the purpose of enabling it to move freely within the mortise of the driver, notwithstanding any bending of the driver upon the spindle."

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32. For improvements in the *Condensing Apparatus of Steam Engines;* Daniel Treadwell, Cambridge, Massachusetts, March 31.

The claim attached to the specification will fully explain the principle of this condenser—it is as follows, viz. "In claiming letters patent for the condenser, as described, I would not be understood as intending my claim to embrace the general principle of condensing by an effusion of water upon the condensing vessel, nor for making said condensing vessel of numerous pipes or tubes, instead of one simple cavity. But my invention, for which I claim a patent, consists in forming the condenser with curved pipes, which pipes pass from, and return to, the same plate by which they are supported, and which plate covers the two cavities, into one of which the steam passes from the exhaust pipe of the engine, and the other receives the water formed by the condensed steam. This form of construction having the following advantages. 1st. All the pipes are supported by the same body. 2nd. They are all opened to be cleaned, by a removal of the back plate. 3rd. They are free to expand and contract without causing their ends to move. 4th. The outside of the pipes are open and exposed, so that they can be cleaned without removing any part on which their support depends. 5th. They are, by means of being secured by soldering to the plate, placed nearer together than in any other form of fixture."

33. For *Preparing White Lead Paint;* James N. Trovillo, Christiansburg, Virginia, March 31.

This improvement consists in incorporating with a given quantity of white lead, equal, or nearly equal, quantities of linseed oil and of pure water, preparatory to grinding the paint, by first carefully incorporating the water and lead, and then adding the oil, and also in subsequently reducing it to a proper consistence by the addition of the same materials in the same proportions. The patentee says, "I do not claim, to be the first to have incorporated linseed oil and water together in the preparation of paint, with a view to economy in the use of the former article, this having been done by the aid of lime or other alkaline substances; but what I do claim, is the producing of this combination by the agency of white lead alone, substantially in the manner set forth, for the purpose of producing a mixture to be employed as a paint applicable to all the objects to which white lead paint is ordinarily applied."

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34. For an improvement in *Steam Boilers;* Jacob B. Eversole, St. Louis, Missouri, March 31.

The patentee states that the object of his improvement is to prevent the vapour, generated at the bottom of the boiler, from coming in contact with the bottom of the flue, and there forming a sheet, which prevents the water from coming in contact with the heated metal. This he effects by means of a semi-cylindrical guard plate of metal, which he places between the bottom of the flue and the bottom of the boiler, and supports by legs or rods resting on the latter. The steam that is generated at the bottom of the boiler, in rising, comes in contact with the bottom of the guard plate, which carries it up and prevents it from coming in contact with the bottom of the flue. It is evident, however, that the remedy will only be partial, for the steam which impinges upon the bottom of the guard plate, will soon elevate its temperature until it becomes nearly equal to that of the steam—and this will generate steam above the guard plate, which, in rising, will impinge upon the bottom of the flue. The claim is confined to the placing of a guard plate between the flue and the bottom of the boiler.

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35. For improvements in *Machinery for removing Stumps;* Miles C. Mix, Tompkins county, New York, March 31.

It would be useless to attempt to give a clear idea of this machine within the narrow limits of this notice, without drawings; suffice it to say, that the chain which is attached to the stump, and by which it is drawn up, is attached to a revolving shaft, on which it is wound as on a windlass, by means of a peculiarly arranged system of gearing, which facilitates the change of relative velocity between the point where the force is applied and the shaft on which the chain is wound. This shaft and gearing are placed in a frame provided with two wheels at one end, and a truck roller at the other, so arranged as to

allow the ends of the frame to rest on the ground, that the whole may be attached or anchored for operation.

The claim is in the following words, viz. "What I claim as my invention, is the particular manner of obtaining the power by the construction and arrangement of the gearing, as herein described, that is to say, the mode of operating by two or more sets of double pinions on two differential wheels through the intermedium, and by means, of an apparatus combined and connected substantially, as herein set forth."

Proceedings in an Appeal from the decision of the Commissioner of Patents, HENRY L. ELLSWORTH, ESQ., *rejecting the application of* JOHN F. KEMPER, ESQ., *of Cincinnati, Ohio, for a Patent for an improvement in the manner of stowing Ice.*

The Editor was employed by Mr. Kemper to solicit and obtain a Patent for "*certain improvements in the manner of constructing vessels for carrying and stowing ice, and also an improvement in the manner of stowing the same;*" which application was duly made, and the claim to the manner of constructing the vessels admitted, while that to the manner of stowing the ice, was rejected, by the Commissioner of Patents, as not being, in his opinion, the proper subject of a Patent, and upon this decision, the subjoined proceedings have been had.

Under the provisions of the 7th section of the act of July 4th, 1836, an appeal from the decision of the Commissioner was allowed, in certain cases, to a board of examiners, consisting of three persons, to be appointed by the Secretary of State. Several appeals were made under this act, but the mode of proceeding was liable to so many objections as to render the repeal of this provision not only desirable, but absolutely necessary; on the 3rd of March, 1839, "an act in addition to an act to promote the progress of the useful arts," was passed, the 11th and 12th sections of which are in the following words.

"SEC. 11. *And be it further enacted,* That in cases where an appeal is now allowed by law from the decision of the Commissioner of Patents to a board of examiners provided for in the seventh section of the act to which this is additional, the party, instead thereof, shall have a right to appeal to the Chief Justice of the District Court of the United States for the District of Columbia, by giving notice thereof to the Commissioner, and filing in the Patent Office, within such time as the Commissioner shall appoint, his reasons of appeal, specifically set forth in writing, and also paying into the Patent Office, to the credit of the patent fund, the sum of twenty-five dollars. And it shall be the duty of said Chief Justice, on petition, to hear and determine all such appeals, and to revise such decisions in a summary way, on the evidence produced before the Commissioner, at such early and convenient time as he may appoint, first notifying the Commissioner of the time and place of hearing, whose duty it shall be to give notice thereof to all parties who appear to be interested therein, in such

manner as said judge shall prescribe. The Commissioner shall also lay before the said judge all the original papers and evidence in the case, together with the grounds of his decision, fully set forth in writing, touching all the points involved by the reasons of appeal, to which the revision shall be confined. And at the request of any party interested, or at the desire of the judge, the Commissioner and the examiners in the Patent Office, may be examined under oath, in explanation of the principles of the machine or other thing for which a patent, in such case, is prayed for. And it shall be the duty of the said judge, after the hearing of any such case, to return all the papers to the Commissioner, with a certificate of his proceedings and decision, which shall be entered of record in the Patent Office; and such decision, so certified, shall govern the further proceedings of the Commissioner in such case: *Provided, however*, That no opinion or decision of the judge in any such case shall preclude any person interested in favour or against the validity of any patent which has been or may hereafter be granted, from the right to contest the same in any judicial court, in any action in which its validity may come in question.

SEC. 12. *And be it further enacted*, That the Commissioner of Patents shall have power to make all such regulations in respect to the taking of evidence to be used in contested cases before him, as may be just and reasonable. And so much of the act to which this is additional as provides for a board of examiners, is hereby repealed."

During the period that has elapsed since the passing of the foregoing amendments to the act of 1836, the Editor has been consulted by a number of persons proposing to appeal from the decisions of the Commissioner, adverse to their claims, but he has, in every instance, discouraged the making of such appeal, because in prosecuting it a certain expense must be incurred, and the probable result would be the sustaining of the Office by the Chief Justice. The considerations upon which this advice has been founded, have been that these decisions were, in most instances, believed to be correct, and that where their correctness was matter of doubt, it was not likely that the testimony and opinions presented to the judge would, in ordinary cases, make it clearly his duty to order a patent to issue. By ordinary cases, are intended those in which the question at issue is that of novelty in the invention; a question to be decided upon the substantial identity of two machines, somewhat different in form. This is frequently a very difficult question with the professed mechanician, and one which cannot be viewed as within the purview of those subjects with which it is the duty of a jurist to be familiar; the tendency, therefore, would be, in nearly all cases, to lean to the side of the office, as the Commissioner and Examiners must be supposed to be well acquainted with such matters, and not to have any interest adverse to that of the applicant for a patent. These officers the Judge may examine under oath, and their opinions and reasons must necessarily have great weight in his decision upon the appeal.

Persons who apply for patents do so, generally, under an impression that they have something which is new and useful, and when disappointed in their cherished hopes, by an adverse opinion in the

Patent Office, are prone to apprehend the existence of some improper motive, and not unfrequently ascribe to corruption any decision which contravenes their own opinions of what ought to be, and the Editor is aware that charges of this character against the office, have been extensively promulgated; from his constant intercourse with it, and his intimate acquaintance with its transactions, it is due equally to himself and to justice, here to declare, that he is convinced such charges have not even the shadow of a foundation as their basis. He has frequently differed from the office in matters of opinion, and has forcibly urged the claims of his clients where he has felt that they were just; the present is a case in point; he has believed, and does still believe, that Mr. Kemper had a perfect right to a patent. At the moment of penning these preliminary remarks, the Editor is not in possession of the decision of the Chief Justice in the matter, but anticipates with much confidence that it will be in favour of his client. Should it not be so, however, although he will feel much disappointment, he will, at the same time, be ready to distrust the correctness of his own views in the matter, as the question submitted is one of law, and therefore within the special province of the Judge, and is in the hands of one who is equally able and faithful in the performance of his duties. It was because the point at issue was a question of law that Mr. Kemper was encouraged to make the appeal, and in whatever way it may be decided, a rule will be established which will govern the course of the office in analogous cases.

Two years have elapsed since the passing of the law giving an appeal to the Chief Justice of the District, and as the present is the first appeal under it, there was no existing precedent to determine the form of procedure, the publication of all the documents in the case may be of some value as a guide in such as may hereafter occur. By the delay of a day, the decision of the Chief Justice would be known, but the wish of the Editor to publish the case immediately, and his distance from the press, induce him to send off the first part of his copy, in order that it may be in time for the current number of the Journal.

Washington, March 20th, 1841.

To the Commissioner of Patents.

Sir—As Attorney for, and in behalf of John F. Kemper, of Cincinnati, in the State of Ohio, I hereby appeal from the decision of the Patent Office, in the case of the application of the said John F. Kemper for a patent for "certain improvements in the manner of constructing vessels for carrying and stowing ice; and also an improvement in the manner of stowing the same." You are, therefore, hereby requested to take such steps in the premises as are directed and provided by the 11th section of the "Act in addition to an act to promote the progress of the useful arts," passed on the 3rd day of March, 1839; twenty-five dollars having been paid into the Treasury of the United

States, in conformity with the requirements of the act of Congress in that case, made and provided.

THOMAS P. JONES, Attorney for JOHN F. KEMPER.

Washington, December 14th, 1840.

To the Hon. WILLIAM CRANCH, *Chief Justice of the District Court of the United States for the District of Columbia.*

The petition of John F. Kemper, by his Attorney, Thomas P. Jones, respectfully represents, that he has made application to the Commissioner of Patents, for the grant of letters patent of the United States, for "certain improvements in the manner of constructing vessels for carrying and stowing ice; and also an improvement in the manner of stowing the same;" that the Commissioner of Patents has decided that a patent cannot be granted for the last item in his said improvement, to wit: "an improvement in the manner of stowing the same," which decision your petitioner verily believes to be in contravention of his rights as the inventor or discoverer thereof, for reasons which will be fully set forth, at such time as may be appointed, agreeably to the provision of the 11th section of the act of Congress, entitled "An act in addition to an act to promote the progress of the useful arts," passed on the 3rd day of March, 1839. Your petitioner having paid twenty-five dollars into the Treasury of the United States, and having also given notice to the Commissioner of Patents of this appeal.

All of which is respectfully submitted.

JOHN F. KEMPER.

By his Attorney THOMAS P. JONES.

Washington, March 14th, 1840.

To the Hon. WM. CRANCH, *Chief Justice of the United States Court for the District of Columbia.*

Thomas P. Jones, Attorney for John F. Kemper, presents the following statement, and plea, on the claim of said John F. Kemper to a patent for what is believed to be a new and useful discovery.

In the case of John F. Kemper, of Cincinnati, in the state of Ohio, who has made application to the Commissioner of Patents for a patent for "certain improvements in the manner of constructing vessels for carrying and stowing ice; and also an improvement in the manner of stowing the same;" a letter was received from the Commissioner of Patents, dated March 24th, 1840, of which the following is a copy.

Patent Office, March 24th, 1840.

"SIR,—The specification of your improved vessel for stowing and carrying ice is herewith returned for amendment in the claim, which is deemed to be too broad, the mode of arranging the ice by placing the blocks edgewise, cannot, in the judgment of this office, constitute a claim to a patent, as it is believed that every one has a right to pack away ice by placing the blocks either edgewise or in any other posi-

tion. The mode of caulking does not present any thing substantially new, the same having long since been effected.

Yours, respectfully,

MR. JOHN F. KEMPER. H. L. ELLSWORTH."

Care of Dr. T. P. JONES, Agent, Washington, D. C.

After the receipt of the foregoing letter, I had, on behalf of Mr. Kemper, several conversations with the Examiner of Patents, upon whose report the foregoing letter was founded, and as these did not result in any change of opinion, it was proposed to refer the question to the final decision of the Commissioner of Patents; upon this point, and on some others, I subsequently corresponded and consulted with Mr. Kemper, and finally the question of his right to a patent under that part of his specification and claim which relates to the packing of ice edgewise, was submitted to the Commissioner. The part in controversy, so submitted, and as contained in the specification and claim, is in the following words.

"I have discovered that for the purpose of keeping ice for a great length of time, it is necessary, in stowing it, to place all the pieces edgewise, as when placed flatwise, small openings are formed through it by the percolation of water, or otherwise; and that this injurious effect goes on increasing, and, eventually, producing a rapid destruction thereof. This I obviate by carefully packing all the blocks edgewise, when, as experience has abundantly shown, no such effect is produced. This mode of stowage applies not only to vessels but also to ice houses, &c., and wherever ice is to be preserved.

"In the manner of stowing the ice, I claim the placing of the prepared blocks edgewise, in the manner, and for the beneficial purpose, herein set forth."

On, or about, the 10th of September, a paper was placed in my hands, by the Commissioner of Patents, of which the following is a copy.

"Ice houses have been packed either by placing the ice on the edge, or flatways, indiscriminately; if one person finds that placed on the end keeps best, and uses accordingly, this is no invention.

"If apples keep best on the end, a patent would not be granted for the exclusive use of packing them thus, though generally they are thrown in promiscuously. If cider would keep better by placing the bottles horizontally, than allowing them to stand upright, this could not be patented, as both methods are used; in neither case is there any thing new. The applicant only uses the invention or directions of another, and finds one course recommended better than another.

H. L. ELLSWORTH."

It appears to me that in the case in hand the office has entirely mistaken its powers and its duties, and has assumed an authority not intended to be given to it by the legislature.

Under the laws of the United States patents are granted for "any new and useful art, machine, manufacture, or composition of mat-

ter; or any new and useful improvement on any art, machine, manufacture, or composition of matter, not known or used by others before his or their discovery or invention." Act of July 4th, 1836, sec. 6.

The powers of the office to grant or to refuse a patent are designated in the 7th section of the same act, where it is provided that "if on any such examination it shall not appear to the Commissioner that the same had been invented or discovered by any other person in this country prior to the alleged invention or discovery thereof by the applicant; or that it had been patented or described in any printed publication in this or any foreign country, or had been in public use, or on sale with the applicant's consent or allowance prior to the application, if the Commissioner shall deem it to be sufficiently useful and important, it shall be his duty to issue a patent thereof."

It is not pretended in either of the communications from the office, above cited, that the discovery in question is placed in either of the conditions that would justify the refusing of a patent, under the law. In that of March 24th it is said to be "believed that every one has a right to pack away ice by placing the blocks either edgewise or in any other position;" a right which most certainly is not disputed; but the same may be said of the use of any invention or discovery that has ever been made; every one had *a right* to make it, and having made it, if not injurious to the community, he would have had *a right* to use it; and were there not a law vesting an exclusive right in inventions or discoveries, under certain conditions, every one else would have had the same right; the averment in the foregoing quotation seems, therefore, not to be based on any tenable ground. Does it appear "that this alleged discovery had been patented or described in any printed publication in this or any foreign country, or had been in public use?" this is not pretended; nor is it alleged that "the Commissioner" does not "deem it sufficiently useful and important," and is it not, therefore, "his duty to issue a patent therefor?"

The allegation of my client as respects the beneficial results of his manner of stowing ice, has been made after repeated and comparative trials; and he is fully satisfied of the verity of the discovery; such being the fact, it does not require any laboured argument to show that it is a discovery of very great value. In stowing ice, the whole intention is to preserve it either on voyages or for domestic use; and any new mode of constructing an ice house for that purpose would, confessedly, be patentable. In the case before us, the office assents to the grant of a patent for the construction of a vessel in which the ice is to be stowed, but refuses one for a new manner of stowing it, because, according to its statement, "every one has a right to pack ice away by placing the blocks either edgewise or in any other position." So also every one had a right to build a vessel for preserving ice, just as Mr. Kemper has built his; and yet an exclusive right to its use is granted to him for fourteen years, whilst it is refused for an auxiliary means of attaining the same end.

The communication from the office, received, as above stated, on or about the 10th of September last, seems to me not to offer any valid reason for not granting the patent. Ice has been thrown, or packed, in

ice houses "indiscriminately;" and from this it seems to be inferred that a discriminating mode, which it is alleged and believed produces a new and useful effect, is not the subject of a patent; and why? because "if one person finds that ice placed on the ends keeps best, and uses accordingly, this is no invention." Is it no "discovery" for one to find out what had not before been known, that "placed edgewise," the blocks of ice will be preserved for a much longer time than when placed *indiscriminately?*

The illustration offered in the supposed case of apples keeping best on their ends may be passed over, as it is merely followed by a declaration "that a patent would not be granted for the exclusive use of packing them thus." Whether it would, or ought, to be granted, is not a question which I am called to discuss. The remark respecting cider in bottles is still less relevent, as it is stated that "both methods are used," and that, therefore, the laying them on their sides "could not be patented," a conclusion, the correctness of which is fully admitted; but how this is to be applied to a method of packing ice, which method *has not been used*, does not appear.

On the 4th of May, 1838, a patent for an improved mode of packing and stowing ice, was granted to Frederick Tudor, of Boston. The improvement consisted simply in filling the interstices between the blocks of ice with any nonconducting material, such as saw-dust, chaff, pulverized cork, or any other that may be preferred. The patentee says, "my improvement consisting entirely in the filling of the spaces usually left between the separate blocks of ice with any suitable nonconductor, it having been found that by so doing the ice is preserved from melting for a much longer period than usual." The main object in this case was, it is supposed, to exclude the atmospheric air. If the applicant had been told that every one had a right to pack away ice by placing chaff, &c., between the separate blocks, as well as to surround the whole mass with such materials, he would have been placed in a predicament like that of my client; but in this case the patent was granted, and most certainly for what was less obviously a new discovery then is the fact that by packing the whole mass edgewise, the ice will be preserved from melting for a much longer period than usual.

I might give a long list of patents for processes, or modes of procedure, in preserving animal and vegetable substances, by means extremely simple, which have been granted and sustained under the statute of monopolies in England, the wording of which is much more limited than our own statute in its enumeration of patentable subjects; and I might also cite many which have been granted, and I believe correctly granted, under the existing laws, by the patent office of the United States, which appear to rest upon a much narrower basis than that now demanded; but this I consider at present unnecessary, especially when addressing myself on a question of law, to one having the requisite materials at his command, and so much better prepared to use them aright, than I can pretend to be.

In deciding upon the right of an applicant to a patent the professed rule of the office is, "that where the question is at all doubtful, the

patent should be granted," as the final decision of the right, in such cases, belongs to the courts, and not to the Commissioner of Patents; this rule I am fully aware has, in most cases, been faithfully observed, and I am really at a loss, therefore, to perceive upon what ground it has been so widely departed from in the present instance. Is the proposed plan unquestionably old? This is not even hinted at. Is it "frivolous or injurious to the well being, good policy, or sound morals of society?" Assuredly not. [See 1 Mason 186, Lowell *v.* Lewis.] I therefore most confidently anticipate that your honour will see good ground to reverse the decision of the Commissioner of Patents, and direct that a patent be issued to my client, admitting his claim to "the placing of the prepared blocks edgewise, in the manner and for the beneficial purpose herein set forth."

THOMAS P. JONES, Attorney for John F. Kemper.

To the Hon. WM. CRANCH, *Chief Justice of the United States Court for the District of Columbia.*

The Commissioner of Patents presents to the Honorable Judge, the following as the reasons which governed him in the rejection of John F. Kemper's claim to a patent for a mode of packing ice in vessels for transportation, and in ice houses.

John F. Kemper of Cincinnati, Ohio, made application for a patent on the 20th of March, 1840, for "improvements in the manner of constructing vessels for the stowing and carrying of ice, and also for an improvement in the manner of stowing the same in vessels and ice houses."

No objection has been made to the grant of a patent for the novel construction of vessels for the transportation of ice as claimed by him, but the Commissioner of Patents decided that he was not entitled to receive a patent for the manner of stowing the ice by placing the blocks edgewise, nor for the caulking between the several blocks as described and claimed in his specification—the former because, in the judgment of the Commissioner, it could not constitute a legitimate claim to a patent, for the want of novelty; and the latter for the want of novelty. From the decision on the former, viz. the mode of stowing by placing the blocks edgewise, he has appealed, and to the latter, viz., the caulking between the blocks he has acquiesced.

The Commissioner indulges the belief that a bare statement of the objections to the grant of a patent for stowing ice by placing the blocks edgewise, without any laboured arguments, will explain to the Honorable Judge the soundness of his decision.

It will not be pretended by any one that blocks of ice have not been placed edgewise in vessels for transportation, and in ice houses for preservation. The fact is too well known to need proof.—In vessels the blocks have been placed in every possible position with the view of saving room in stowing, and any one who has seen ice stowed away in ice houses must have observed that the blocks are frequently placed edgewise. If then blocks of ice have been thus placed, the position has not been invented by Mr. Kemper. What then has been

invented? Is it placing all the blocks edgewise? This is not, however, an invention, for it matters not whether two or one thousand blocks have been thus placed, as the greater or lesser number cannot constitute a claim to a patent. Is it then the discovery that blocks of ice thus placed will be preserved longer than when placed in any other position? The stress laid upon this fact by Mr. Kemper's attorney, in the specification, and in his argument, indicates that this is the main ground of his claim. If a discovery were the subject of a patent this would be a good claim on the score of novelty, but it is believed that the test of usefulness would have to be applied with great liberality, as it has been shown by experience that the more compact ice can be packed, the longer it will keep, for one large solid block will keep longer than several small pieces of an equal bulk placed side by side. It is believed that if ice were placed edgewise a passage would sooner be made for air or water, by the melting of the ice on the sides, than if laid flatwise; for, in the former case, water trickling down, would, by attraction, continue in contact with the block in passing from the upper to the lower edge, but in the latter, it would remain upon the surface and only in contact with as much of the ice as it could cover in a state of rest—but to return. A discovery, is to bring to light something which has had existence before, and the very reverse of an invention, which is the contriving or producing something which did not before exist. It is not deemed necessary to go into a minute investigation of the meaning of the two terms to be submitted to one who needs no such explanation. The decisions of the courts are replete with opinions against the grant of patents for discoveries except when the term is used as synonimous with invention. As, for instance, a learned judge argues, he who discovered atmospheric pressure was not entitled to receive a patent for such discovery, but he who invented the suction pump, contrived something which did not exist before, and was entitled to receive a patent for it. So of the barometer. And, again, the man who discovered that steam in expanding exerted great force, was not an inventor, but the one who contrived the steam engine was. The courts have also decided that the application of a known thing to a new purpose is not the subject of a patent.

A machine has been invented for a given purpose, and another person discovers that it can be advantageously applied to another purpose—this is to disclose or discover something not known before, but it is not inventing or contriving, and therefore not patentable. It cannot be seen by what process of ratiocination it can be shown that *position can be invented*—it has existed from the beginning of time, and cannot be the subject of invention. Nor can it be shown that, to discover by any series of experiments, or by accident, that a certain position of any thing produces a beneficial result, is an invention and patentable under the statute. As well say that a person who should discover that to plant a given kind of seed so many inches under ground would make it produce better, and that for it he would be entitled to receive a patent. Or that he who should discover that certain winds prevailed during the winter, and that to build houses with the gable

side towards such winds would make the house warmer, and that for such discovery he would be entitled to a patent. Or that he who should discover that piling wood vertically, instead of horizontally, would keep better, would, for that, be entitled to receive a patent, and thus prohibit all others from piling wood vertically. The grant of a patent for placing the blocks edgewise, for this purpose, would prevent any one from placing them in the same position for another object; and if it would prevent them from stowing away a whole cargo, it would prevent them from stowing away a part of a cargo, and thus all persons would be prohibited from placing blocks of ice edgewise. Can it be believed that the Legislature ever intended thus to restrict the public right? It cannot be. Other arguments might be advanced, but it is believed to be so plain as to need no other illustration.

The Commissioner will notice an argument advanced by Mr. Kemper's attorney.—He has referred to a patent granted to Frederick Tudor, of Boston, on the 4th of May, 1838, for an improved mode of packing ice, by filling up the interstices between the blocks of ice with any non-conducting material. This is cited as a precedent.

Upon a review of this patent the novelty does appear questionable; but it matters not, as the case is not in point—there is no analogy between it and placing blocks of ice edgewise. It was known that the interstices between blocks of ice would admit air, and that if the air should be of a temperature above the freezing point, the consequence would be the melting of the ice; this is a discovery and not patentable, but he contrived a mode of preventing it by filling up the interstices with some non-conducting material. This is an invention, and as such, the subject of a patent; but if the interstices between blocks of ice had been filled up with some non-conducting material before, for some other purpose, and Mr. Tudor had merely discovered that it would prevent the admission of air, and thus the melting of the ice, he would not have been entitled to a patent. This supposed case is analogous to Mr. Kemper's claim, but as the patent was granted for the contrivance, it bears no analogy. If the contrivance, or invention, patented by Mr. Tudor was not new at the time the patent was granted, then it only shows that the patent ought not to have been granted, but it is no argument in favour of the present claim.

The Commissioner will remark, in conclusion, that there is another and insuperable objection to the claim in question.

Mr. Kemper's application covers two separate and distinct inventions which cannot be included in or covered by one patent, viz—improvements in the construction of vessels for the transportation of ice, without reference to the manner of packing or stowing away the ice, and also improvements in the manner of packing or stowing ice in vessels and in ice houses. The two have no dependence upon each other. The vessel can be used for transporting ice packed in any manner,—and the method of packing can be used in vessels thus constructed, or in any other manner, or in ice houses of all constructions.

All of which is respectfully submitted.

HENRY L. ELLSWORTH.

February 17th, 1841.

To the Hon. Wm. Cranch, *Chief Justice of the United States Court for the District of Columbia.*

Sir—As Attorney for Mr. John F. Kemper, I present to your consideration the following remarks in answer to the reasons given by the Commissioner of Patents for his rejection of the claim of Mr. Kemper, to his mode of stowing ice.

It is said, by the Commissioner, that he, Kemper, "was not entitled to receive a patent for the manner of stowing ice, by placing the blocks edgewise," "because, in the judgment of the Commissioner, it would not constitute a legitimate claim to a patent, and for want of novelty." It is also said that "it will not be pretended by any one that blocks of ice have not been placed edgewise in vessels for transportation, and in ice houses for preservation. The fact is too well known to need proof." A *discovery*, it is also argued, cannot be the subject of a patent, and that "it cannot be seen by what process of ratiocination it can be shown that *position can be invented.*"

It is somewhat strange that it should be asserted that a *discovery* is not the subject of a patent, when the provisions of the constitution of the United States, upon which the patent law is founded, gives to Congress the power of securing "to authors and inventors, the exclusive right to their respective writings, and *discoveries.*" It is admitted that a *discovery*, taken abstractedly, is not patentable, but if the thing discovered be practically applied to produce a new and useful effect, the manner of attaining this end is patentable. The 6th section of the act of July 4th, 1836, provides "that any person having *discovered* or invented any new and useful art, machine, manufacture, or composition of matter, or any new and useful improvement on any art," &c.

The question at issue is whether Mr. Kemper has made any such "new and useful improvement on any art" as to entitle him to the protection of the patent law; and, to the undersigned, it seems that few things are more palpable than the obligation to answer this question in the affirmative. Is it not admitted that the art of preserving ice is a useful art? Improved modes of constructing ice houses have been the subjects of patents both here and in England; the office, in the case before us, has allowed the claim to the manner of forming a structure for this purpose, but has refused it for a new method of stowing the ice, by which the end proposed is more effectually attained. Is it not an improvement in the art of preserving ice, so to dispose the blocks as that they shall be prevented from melting for a longer period of time than has heretofore been done? The assertion that "it will not be pretended by any one that blocks of ice have not been placed edgewise in vessels for transportation, and in ice houses for preservation," appears to be based upon ground altogether untenable, as it certainly "will not be pretended," that in vessels or in ice houses, ice had ever been stowed away upon the system adopted by Mr. Kemper; and this new and useful improvement in the art is founded upon a discovery made by him, namely, that if a mass of ice be stowed away in such manner as that the part which formed

the edges in the act of freezing, are placed in the reverse position when stowed away, the process of melting, or thawing, will be thereby retarded. I will ask, Sir, had this discovery ever been made, or the improved mode of stowing, founded upon it, ever been practiced before by any other person? That this is the case is not pretended. To say that because in filling ice houses, or vessels, with ice thrown in at random, some of the pieces so thrown in would assume the position designated, the claim to a new system of stowing ice would be invalidated, is to assert that, the unsoundness of which is too evident to call for any laboured arguments for its refutation.

In the well known case of the achromatic telescope, invented by Dolland, it was shown that a Dr. Hall, of Scotland, had constructed two telescopes upon the same principle with that of Dolland's forty years before his invention of it, but had not pursued the matter either to his own benefit or to that of the public; Dolland was, therefore, held to be the true inventor, and his patent was sustained. In this case there was, on the part of Hall, study, design, and system; but we are now to be told that because in throwing or heaping together a quantity of ice in separate pieces, some of these pieces will fall in the position designated by Mr. Kemper, he is not entitled to a patent. It certainly, Sir, is not necessary to inform you, or the Commissioner of Patents, that it is a settled principle in law, that a patent cannot be invalidated by showing that something of the nature of the thing patented had fortuitously occurred, or had been produced, without its attracting due attention, and leading to any beneficial result. It is probable that there are but few of those processes in chemistry by which new compounds have been produced, and for which patents have been granted, that had not previously been accidentally and unwittingly performed; but would proof of this invalidate a patent? In the case before you, Sir, no such evidence can be stated, and the doctrine assumed, were it tenable, would invalidate a large proportion of the patents that have been issued and sustained.

The argument attempted to be founded on the matter of Tudor's patent, cited by me in my first communication, appears to be altogether forced and inconclusive. It is not pretended by me that a discovery *per se* is the subject of a patent; but every invention must be founded on some discovery; and when a fact is discovered, and this discovery leads to some new and useful procedure, such procedure becomes a patentable subject. The discovery may be made by one person, and the patentable application of it by another, and such is usually the case; but in the present instance, they are both the work of the same individual, Mr. Kemper having discovered that ice exposed to the action of those agents which dissolve it, is, when placed edgewise, affected by them much more slowly than when piled or packed indiscriminately, in the ordinary way; and upon this discovery he founds a new and useful system of packing or stowing ice, and of thus preserving it, unmelted, for a longer period than by any other mode previously adopted. We are informed that Mr. Tudor did not make any discovery, but that he invented a mode of preserving the blocks of ice from decay, by filling the interstices between them with some non-

conducting substance, that excluded the air. It is said that "if the interstices between blocks of ice had been filled up with some non-conducting material before, for some other purpose, and Mr. Tudor had merely discovered that it would prevent the admission of air, and thus the melting of the ice, he would not have been entitled to a patent." It is then asserted that "this supposed case is analogous to Mr. Kemper's claim." Such, however, is not the fact, there is not any analogy between the two cases. Mr. Kemper, in his claim, says, "In the manner of stowing the ice, I claim the placing of the prepared blocks edgewise, in the manner, and for the beneficial purpose herein set forth." His claim, therefore, is to the doing of a new thing, one that had never been done before, either by accident or design, and by which mode of procedure a new and beneficial result is secured.

The Commissioner is at a loss to see how it can "be shown that position can be invented;" and this declaration is followed by some observations respecting position, the incorrectness and inapplicability of which are, it seems to me, quite evident. The position in which propellers have been placed on steamboats; the position in which the buckets of such wheels have been placed, and of a thousand other things in which position constituted the leading improvement, might be cited in proof of the utter irrelevency of such a remark. Within a few days a patent has been granted to Mr. Wm. W. Van Loan, of Cattskill, New York, for placing the ordinary paddle wheels of steamboats in a position which they had not previously been made to occupy. Instead of standing vertically, they are placed obliquely, and the claim made, and admitted by the office, is in the following words. "These wheels are to be moved by means of cranks, or in any of the known ways in which propelling wheels are made to revolve; the only novelty in my invention being the *position* in which I place said wheels, and cause the paddles to operate. What I claim, therefore, as constituting my improvement, and desire to secure by letters patent, is the placing of the said wheels in the *position* herein fully made known and represented, so that they shall enter the water in a direction similar to that of oars in the ordinary process of rowing, the whole operating substantially in the manner described."

It is said by the Commissioner, in relationship to Mr. Kemper's mode of stowing ice, that "it is believed that the test of usefulness would have to be applied with great liberality." And this remark is followed by some conjectures respecting the supposed result of stowing ice edgewise. This, sir, I conceive, is not a question upon which the Commissioner is to decide. On this point I will merely quote from Judge Story's opinion in the case of Lowell *v.* Lewis, 1. Mason 132. "In my judgment the argument is without foundation, all that the law requires is that the invention should not be frivolous, or injurious to the well being, good policy, or sound morals of society. The word *useful*, therefore, is incorporated into the act in contradistinction to mischievous, or immoral. For instance, a new invention to poison people, or to promote debauchery, or to facilitate private assassination, is not a patentable invention. But if the invention steers wide of these objections, whether it be more or less useful is a cir-

cumstance very material to the interest of the patentee, but of no importance to the public. If it be not extensively useful it will silently sink into contempt and disregard."

It is now stated, for the first time, that "Mr. Kemper's application covers two separate and distinct inventions, which cannot be included in, or covered by, one patent," and the Commissioner avers that this "constitutes an insuperable objection to the claim in question." Although it is believed that the opinion thus given is not invulnerable, as the construction of the vessel, and the manner of stowing the ice are part and parcel of one single invention, the preservation of the ice, yet, waiving this consideration, the only result would be that my client must obtain two separate patents, instead of including the two claims in one. The matter before you, Sir, is not a question upon the payment of thirty dollars into the Treasury of the United States, but upon the right of my client to a patent for a new and useful improvement in the manner of preserving ice.

In conclusion, Sir, I will now refer to two cases of the grant of patents by the office, in addition to that of Tudor's, cited by me in my former statement and plea; my object in this case being to show that it has been the practice of the office to grant patents upon claims of a very doubtful character, and, as I believe, on the ground of their being doubtful. These cases are such as have been decided since the passing of the Act of July 4th, 1836, giving to the Commissioner of Patents a certain extent of judicial power in relation to the granting of patents, in addition to the ministerial duties imposed by the Acts of Congress formerly existing. I might cite a number of other cases, with a similar view, but I do not deem it necessary so to do.

On the 15th of February, 1838, a patent was granted to A. D. Ditmars, under the claim to "the preservation of grass for hay, by excluding it from the air, in sheet lead, in the manner set forth." This manner consisted in the forming of air tight bins, or boxes, in barns, &c., which boxes were to be lined with sheet lead, and the lids of which were to be secured down, either by soldering, or otherwise, in such manner as to exclude the air. The grass was to be placed in these boxes in its green state, but free from dew or rain, and it was avered that by this means it would be preserved from decay.

On the 16th of November, 1839, a patent was granted to John H. Stevens for an improvement in friction matches. This improvement consisted in the preserving of the matches from accidental ignition by covering them with a coat of varnish, and it is stated that for this purpose various substances might be employed; what is generally used "is a little solution of gum mastic made with spirits of turpentine, or of an alcoholic solution of gum copal, or of gum mastic; but other glutinous gums, resins, tenaceous matters, or compounds, may be used."

These cases will serve to show that the amount of novelty required by the office to justify it in the granting of a patent is but small, and such must necessarily be the case if its object is, as the Act of Congress establishing it indicates, to "Promote the progress of the Useful Arts," for under any other manner of procedure its tendency would be to

impede their progress. In the case of Ditmars, the patentee had made no new discovery, it having been a well known and long established fact, that the exclusion of air tended to retard putrefaction, but he had applied a well known principle to the attaining of a useful, and it may be, of a new, end; in his procedure there was very little of invention, and it is believed that his title to a patent must have been a matter of much doubt, and that in consequence of the existence of this doubt, the patent was granted to him.

In the case of Stevens, the novelty was, perhaps, still less than that in Ditmars. The coating of wood with varnish to protect it from moisture, and for other purposes, is a thing known to every person, yet as it was, no doubt, believed to produce a new and useful effect in its application to the friction match, the office ordered the patent to issue.

The right of my client to a patent, from the considerations urged, appears to me so manifest as really to render the demurring of the office in the matter, a subject of surprise, as I well know that the objections made have not originated in any improper motive, or bias; but I am compelled to believe that a doubt having been at first entertained and expressed, the pride of consistency, however unwillingly, has entered, to no small extent, into the reasoning upon which this doubt has been made to assume the form of absolute decision. In every case, and there have been a number, in which my clients have proposed to appeal from the decision of the office, adverse to their claims, I have advised submission, but in the present instance I have believed that the appeal provided for in such cases was due to a full and just examination of the matter in question.

All which is respectfully submitted.

THOS. P. JONES, Attorney for John F. Kemper.

Washington, March 14th., 1841.

TO BE CONTINUED.

The Mathematical Power Loom.—By the introduction of this invention it is expected a powerful stimulus will be given to a staple manufacture in this country—viz., the linen trade, which has for many years been in a drooping state, chiefly owing to the low price of labour in Scotland. The mathematical loom is equally applicable to the manufacture of worsted, cotton, and all other fibrous substances. This machine is called a mathematical loom, because the quantity of weft, or woof, is determined by calculation or measurement, thus securing at pleasure cloth of any fabric or stoutness, and perfectly equal throughout. The pressure upon the warp-thread can be varied to suit the strength of the warp; so that the strongest or most delicate yarns can be woven, and a firm or soft fabric produced without any difficulty. This loom performs the whole work of weaving, and will produce a piece of cloth of the ordinary length without the alteration of any of its parts. It has woven two bolts, or thirty yards, of the heaviest sailcloth in twelve and a half hours; and the inventor has stated that he would undertake to do that quantity in less time.—*Durham Chronicle.* Athenæum, December, 1840.

Durability of Leather.—Visitors to the Hospital of St. Cross, near Winchester, are shown in the hall two leather stoups or black-jacks for ale, which are, upon pretty good authority, stated to be three hundred years old. Perhaps a more striking proof could hardly be advanced that there really is, for durability, "*nothing like leather.*"

Mechanics' Magazine, November, 1840.

Deposition of Moisture on Metals.—If we place, in an atmosphere saturated with humidity, a piece of polished zinc and a piece of tarnished lead in contact, when the temperature lowers, the lead becomes covered with dew, and the zinc remains dry without oxidising. It is thus with two different metals. The moisture settles on one only. If the effect be attributed to electricity we must conclude that the droplets are electrified positively.—*M. Bonsdorf. Annales des Mines.*

Mining Review, September, 1840.

Meteorological Observations for March, 1841.

Moon.	Days	Therm. Sun rise.	Therm. 2 P.M.	Barometer. Sun rise.	Barometer. 2 P.M.	Wind. Direction.	Wind. Force.	Water fallen in rain.	State of the weather, and Remarks.
				Inch's	Inch's			Inches.	
	1	31	54	29.78	29.78	W.	Moderate.		Partially cloudy—do do.
	2	36	56	.78	.85	W.S.	do		Lightly cloudy—do. do.
	3	34	48	.70	.70	NE.	do.		Cloudy—clear.
	4	34	42	.90	.90	NE	do.		Clear—do
	5	21	32	30.00	30.33	W.	do.		Partially cloudy—do do.
☉	6	25	32	.11	29.80	E.	blustering	2.00	Snow—rain and hail.
	7	36	45	29.32	49	W.	Brisk.		Clear—do. do.
	8	35	41	.54	.60	W.	do.		Cloudy—do.
	9	32	40	30.00	30.13	W.	do.		Lightly cloudy—do. do.
	10	33	36	.00	29.96	E.	blustering	.38	Cloudy—snow.
	11	30	39	29.92	30.00	E.	Brisk.		Lightly cloudy—clear.
	12	26	39	30.13	.05	E	do.		Lightly cloudy—sleet snow.
☽	13	31	44	29.23	29.30	W.	do.	1.00	Cloudy—flying clouds.
	14	32	41	65	.70	W.	do.		Clear—cloudy.
	15	22	32	30.06	30.15	W.	Moderate.		Clear—do.
	16	29	25	29.90	29.94	E.	Brisk.		Snow—do.
	17	21	28	30.20	30.22	N.	do.		Snow—cloudy.
	18	28	35	29.93	29.88	N.	do.	.60	Cloudy—hail and rain.
	19	33	51	.93	30.00	W.	Moderate.	.28	Clear—do.
	20	37	70	30.00	29.94	W.	do.		Hazy—hazy.
⊗	21	38	56	.01	30.04	W.	Brisk.		Clear—do.
	22	34	54	.24	.20	E.	Moderate.		Hazy—do.
	23	52	60	29.78	29.11	S.	Brisk.		Cloudy—rain.
	24	22	57	.83	.87	W.	Moderate.	.33	Clear—do.
	25	37	64	30.00	30.05	W.	do.		Clear—do.
	26	40	69	.00	.00	SW.	Brisk.		Lightly cloudy—hazy.
	27	49	70	29.90	29.90	S	Moderate.		Hazy—do.
☾	28	47	71	.80	.76	W	do.		Cloudy—do.
	29	43	44	.85	60	E	Brisk.	.43	Rain—do.
	30	40	40	.60	.85	W.NE.	Moderate.		Cloudy—do.
	31	26	49	30.20	30.10	E.	do.		Clear—do.
	Mean	34.90	48.80	29.90	29.91			5.02	

	Thermometer.		Barometer.	
Maximum height during the month,	71.	on the 28th.	30.33	on the 5th.
Minimum "	21.	" 5th and 17th.	29.23	" 13th.
Mean	41.85		29.905	

METEOROLOGICAL REPORT

FOR THE STATE OF PENNSYLVANIA,

Collated from returns made to the Committee on Meteorology of the Franklin Institute of the State of Pennsylvania, for

MAY, 1841.

	County.	Town.	Observer.	Thermometer. 7, A.M.	2, P.M.	9, P.M.	Maximum.	Minimum.	Mean.	Days omitted.	Register. Lowest.	Mean.	Days omitted.	Barome 7, A.M.	2, P.M.	9, P.M.	Maximum.
1	Philadelphia,	Philadelphia,	G. P. Schively,	57.60	66.48	55.94	84.50	38.00	60.01	2 1/3	31.50	49.76	.	29.91	29.89	29.94	30.
2	Montgomery,																
3	Bucks,	Newtown,	L. H. Parsons,	57.74	63.50	52.80	85.00	33.50	56.35	1/3	29.00	46.02	.	29.93	29.91	29.90	30.
4	Lehigh,																
5	Northampton,	Easton,	Charles Elliot,														
6	Monroe	Stroudsburg,	A. M. Stokes,														
7	Pike,	Milford,	Ralph Bull,														
8	Wayne,	Honesdale,	W. Richardson,														
9	Susquehanna,	Silver Lake,	E. Rose,	47.84	62.90	52.94	93.00	27.00	54.56	.	27.00	45.00	.	27.74	27.76	27.78	28.
10	Luzerne,	Wilkesbarre,	V. L. Maxwell,	52.70	62.98	53.70	88.00	33.00	56.46	5	30.00	46.68	3	29.30	29.26	29.27	29.
11	Schuylkill,	Port Carbon	P. C. Lyceum,	51.07	70.05	51.37	91.00	31.00	57.50	1 1/3	28.00	42.10	.	29.22	29.21	29.25	29.
12	Berks,	Reading,	C. F. Egelmann,														
13	Chester,	West Chester,	Wm. W. Jeffris,	54.02	65.68	56.33	83.00	32.40	58.68	.	28.50	40.23	.	29.43	29.42	29.45	29.
14	Delaware,	Haverford,	Haverford School,														
15	Lancaster,	Lancaster,	Conservatory of Arts,	54.87	67.90	56.58	84.50	34.00	59.78	.	30.00	49.19	.	29.41	29.40	29.42	29.
16	York,																
17	Lebanon,																
18	Dauphin,	Harrisburg,	J. Heisely,	59.26	68.95	65.50	83.00	48.00	64.57	8 2/3	44.00	55.59	9	29.68	29.66	29.67	29.
19	Northumberland,	Northumberland,	Andrew C. Huston,	54.71	64.13	57.31	83.00	32.00	58.72	.	24.00	44.42	.	29.39	29.33	29.39	29.
20	Columbia,	Danville,	C. H. Frick.														
21	Bradford,																
22	Tioga,																
23	Lycoming,																
24	Union,																
25	Mifflin,																
26	Juniata,	Mifflintown,	J. A. Kinkead,	47.42	68.35	54.28	87.00	31.00	56.68	2 1/3	....	....	.	29.40	29.40	29.41	29.
27	Perry,																
28	Cumberland,	Carlisle,	Prof. W. H. Allen,	55.00	64.20	55.16	83.00	34.00	58.12	1/3	31.00	48.22	.	29.30	29.28	29.31	29.
29	Adams,	Gettysburg,	Prof. M. Jacobs,	53.58	70.93	55.80	88.50	34.50	60.10	.	30.50	46.16	.	29.37	29.32	29.34	29.
30	Franklin,																
31	Huntingdon,	Huntingdon,	Prof. Jacob Miller,	54.14	68.03	54.80	88.00	33.00	58.99	1 1/3	....	....	.	29.29	29.28	29.29	29.
32	Centre,	Bellefonte,	John Harris,	55.35	73.26	59.78	88.50	38.00	62.80	15	....	....	.	29.27	29.23	29.25	29.
33	Potter,																
34	M'Kean,	Smithport,	M. R. Atkins,	44.61	60.51	49.36	82.00	27.00	51.49	1	25.00	39.32	.	....	....	....	..
35	Clearfield,																
36	Cambria,	Ebensburgh,	Richard Lewis,	45.90	61.46	48.56	87.00	25.00	51.97	1 2/3	24.00	42.00	1	27.85	27.84	27.85	28.
37	Bedford,	Bedford,	Samuel Brown,	52.08	65.57	56.33	88.00	32.00	57.99	2 1/3	....	....	.	29.16	29.14	29.18	29.
38	Somerset,	Somerset,	George Mowry,	49.45	59.69	50.13	80.00	31.00	53.09	2	26.00	43.13	1	27.82	27.83	27.85	28.
39	Indiana,	Indiana,	Richard White,														
40	Jefferson,	Rose Cottage,	C. C. Gaskell,														
41	Warren,	Warren,	J. E. King,														
42	Venango,	Franklin,	Wm. Connely,	.....	... ..	.....	.....	....	.....	.	....	....	.	28.90	28.90	28.92	29.
43	Armstrong,																
44	Westmoreland,																
45	Fayette,	Uniontown,	J. P. Weethee,	52.90	69.02	54.35	91.00	29.50	58.76	.	....	....	.	28.96	28.96	28.96	29.
46	Green,																
47	Washington,	Cannonsburg,	Prof. A. H. Campbell,														
48	Alleghany,	Pittsburgh,	J. P. Bakewell,	55.19	65.40	68.40	85.00	37.00	63.00	7 1/3	27.00	47.77	.	29.19	29.18	29.22	29.
49	Beaver,	Beaver,	James Allison,	53.00	68.57	55.45	89.00	31.00	59.01	2 1/3	26.00	42.42	3	29.32	29.31	29.31	29.
50	Butler,	Butler,	Jacob Mechling,	51.52	66.03	58.17	86.00	31.00	58.57	1/3	....	....	.	28.77	28.77	28.77	28.
51	Mercer,	West Greenfield,	S. Campbell,														
52	Crawford,	Meadville,	Henry Shippen,	48.83	64.93	50.62	87.00	29.50	54.79	3/3	22.00	40.46	.	28.70	28.69	28.69	28.
53	Erie,	Erie,	Park & Reid,														

Barometer.							Weather.							Winds.													
	2, P. M.	9, P. M.	Maximum.	Minimum	Mean.	Days omitted.	Clear.	Cloudy.	Days omitted.	Rain.	Snow.	Rain and Snow.	Thunder Showers.	Rain in inches.	North.	N. N. E.	N. E.	E. N. E.	East.	E. S. E.	S. E.	S. S. E.	South.	S. S. W.	S. W.	W. S. W.	West.	W. N. W.
1	29.89	29.94	30.23	29.10	29.91	2⅓	14⅔	13⅓	3	13	.....	.....	1	3.289	1	⅔	1⅓	•	•	⅓	2⅔	•	1⅔	1	8⅓	⅓	2	1⅔
3	29.91	29.90	30.20	29.40	29.91	⅓	13⅓	16⅔	⅔	18	1	.....	..	2.887	•	⅓	1⅓	•	•	⅓	4⅓	1	1⅓	⅔	7⅔	1	2	⅓
4	27.76	27.78	28.31	27.14	27.76	•	13⅓	17⅔	•	7	.....	.....	1	1.780	5⅔	•	•	•	•	•	1⅓	•	5⅓	•	3	•	9⅓	•
0	29.26	29.27	29.48	28.82	29.28	5⅓	6⅔	18⅓	6	8	.....	1	1	3.126	1⅔	•	3	•	⅓	•	2⅔	•	⅔	•	7⅔	•	⅓	•
2	29.21	29.25	29.44	28.74	29.23	1⅓	14⅓	15⅓	1⅓	12	.....	1	..	3.069	⅓	•	2	1	⅔	•	1⅔	•	⅓	•	1	⅓	9	⅔
6	29.42	29.45	29.98	28.96	29.43	•	13⅔	17⅓	•	13	.....	.....	..	2.135	2⅓	1	1⅓	⅓	⅓	⅓	•	•	1⅔	•	8⅓	⅔	3	2⅔
1	29.40	29.42	29.66	28.89	29.41	•	15	16	•	13	.....	1	..	2.360	2⅔	1	2	1	•	•	1⅔	3	2⅓	2⅔	3	⅓	1⅓	2⅔
8	29.66	29.67	29.92	29.20	29.67	8⅔	.	.	•	.....	.....	.....	..	.....	⅓	.	.	•	1⅓	•	1⅔	•	4⅓	•	3⅔	•	10⅔	•
9	29.33	29.39	29.68	28.85	29.37	•	7⅓	23⅔	•	11	.....	.....	3	4.285	3⅓	.	2⅔	⅔	⅓	•	2⅔	⅔	3⅔	•	2	•	3⅓	⅔
0	29.40	29.41	29.89	28.92	29.40	2	12	16	3	6	2	.....	1	3.160	.	.	1	.	⅓	.	2	.	.	.	1⅓	.	1	.
0	29.28	29.31	29.55	28.81	29.30	⅓	11⅓	19⅓	⅓	11	.....	.....	..	3.431	2	⅓	1	.	⅔	.	2⅓	⅔	2	⅓	2	⅓	4⅔	1⅔
7	29.32	29.34	29.52	28.86	29.34	•	13	18	•	10	...	.....	1	3.403	⅓	1	3⅔	.	•	•	2⅔	1⅓	3	⅔	4⅓	⅔	2	1⅓
9	29.28	29.29	29.51	28.82	29.29	1⅓	18	13	•	7	1	.....	1	4.300	.	.	.	.	8	.	.	.	.	.	.	.	21⅔	.
7	20.23	29.25	29.38	28.94	29.25	15	.	.	.	.....	.....	.....	..	.....	.	.	.	.	.	.	.	.	.	.	.	.	.	.
.	....	....	....	....	....	•	15⅔	14⅓	1	8	2	.....	2	1.323	⅔	.	⅔	.	⅔	.	3⅓	.	6⅓	.	7⅓	.	9⅔	.
5	27.84	27.85	28.10	27.42	27.85	1⅔	9	19⅔	2⅓	8	1	.....	5	5.784	⅔	.	⅓	.	⅔	.	2⅓	.	2⅓	.	4	⅓	6⅓	⅔
6	29.14	29.18	29.36	28.70	29.16	2⅓	12⅔	16	2⅓	.....	.....	.....	..	.....	.	.	.	⅔	•	2⅓	2	.	⅓	1⅓	3	.	1	.
2	27.83	27.85	28.06	27.49	27.85	2	9	20	2	8	2	.....	2	3.833	⅓	.	1	⅔	⅓	•	2	⅔	⅔	1	4⅓	⅓	5⅔	2
0	28.90	28.92	29.90	28.45	28.91	7	.	.	.	.....	.....	.....	..	.....	.	.	.	.	.	.	3⅔	.	.	.	.	.	.	2
6	28.96	28.96	29.14	28.56	28.96	•	21	10	•	5	.....	.....	..	.....	1⅓	.	2⅓	.	.	.	2⅓	.	.	.	8	.	2⅔	.	1
9	29.18	29.22	29.49	28.36	29.20	2⅓	14	15	2	7	.....	.....	..	3.014	.	.	.	.	1	⅔	4⅓	⅔	.	.	⅔	⅔	1⅓	.
2	29.31	29.31	29.52	28.83	29.31	2⅓	14⅔	13⅓	2⅔	6	.....	.....	..	1.847	.	.	1	⅓	⅓	.	2	.	.	.	2⅓	⅓	.	.	1
7	28.77	28.77	28.90	28.30	28.77	•	.	.	.	5	3	.....	1	2.432	.	.	2	.	4	.	⅔	.	.	⅓	6⅔	.	11⅔	.	.
0	28.69	28.69	28.87	28.20	28.69	1	8	11⅓	11⅔	.....	.....	.....	..	.....	.	.	.	.	.	.	.	.	.	.	.	•	.	.

W. S. W.	West.	W. N. W.	N. W.	N. N. W.	Calm.	Days omitted	Hygrometer. Dew-point.	Days omitted.	Diff. therm. and dew-point.	Wet Bulb.	Days omitted.	No. of Report.
$\frac{1}{3}$	2	$1\frac{1}{3}$	$6\frac{2}{3}$	$\frac{2}{3}$	.	$2\frac{2}{3}$	....	.	.....	....	..	1500
1	2	$\frac{1}{3}$	10	.	.	$\frac{2}{3}$	....	.	.....	....	..	1522
.	$9\frac{1}{3}$	.	$6\frac{1}{3}$	.	.	.	....	.	.....	....	..	1505
.	$\frac{1}{3}$	.	$6\frac{2}{3}$	.	$1\frac{1}{3}$	$6\frac{1}{3}$	....	.	.....	....	..	1486
$\frac{1}{3}$	9	$\frac{2}{3}$	$5\frac{2}{3}$	.	$6\frac{2}{3}$	$1\frac{1}{3}$	....	.	.....	....	..	1491
$\frac{2}{3}$	3	$2\frac{2}{3}$	$8\frac{1}{3}$	$\frac{2}{3}$	.	.	....	.	.....	....	..	1480
$\frac{1}{3}$	$1\frac{1}{3}$	$2\frac{2}{3}$	6	$1\frac{1}{3}$	.	.	50.21	.	.....	58.18	..	1519
.	$10\frac{2}{3}$	.	$\frac{1}{3}$	.	.	$8\frac{2}{3}$	....	.	.....	....	..	1478
.	$3\frac{1}{3}$	$\frac{2}{3}$	5	2	4	.	....	.	.....	60.10	..	1479
.	1	.	8	.	15	$2\frac{1}{3}$	....	.	.....	....	..	1484
$\frac{1}{3}$	$4\frac{2}{3}$	$1\frac{2}{3}$	6	.	$6\frac{2}{3}$	$\frac{1}{3}$	46.58	1	.....	55.07	1	1481
$\frac{1}{3}$	2	$1\frac{1}{3}$	$8\frac{1}{3}$	.	$\frac{1}{3}$	.	50.74	.	.....	58.23	..	1526
.	$21\frac{2}{3}$	.	.	.	.	$1\frac{1}{3}$	....	.	.....	....	..	1508
.	.	.	.	.	.	.	....	.	.....	....	..	1496
.	$9\frac{2}{3}$	.	$\frac{2}{3}$	.	.	$1\frac{2}{3}$	....	.	.....	....	..	1506
$\frac{1}{3}$	$6\frac{1}{3}$	$\frac{2}{3}$	$7\frac{1}{3}$	$\frac{1}{3}$	4	$1\frac{2}{3}$	....	.	.....	....	..	1489
.	1	.	$7\frac{1}{3}$	$10\frac{1}{3}$	.	$2\frac{1}{3}$	....	.	.. .	....	..	1483
$\frac{1}{3}$	$5\frac{2}{3}$	2	2	.	$8\frac{2}{3}$	$1\frac{1}{3}$	....	.	.....	....	..	1499
.	.	.	$22\frac{2}{3}$	.	.	$4\frac{2}{3}$	....	.	.....	....	..	1494
.	$2\frac{2}{3}$	.	10	.	$4\frac{1}{3}$	.	....	.	.....	....	..	1604
$\frac{2}{3}$	$1\frac{1}{3}$	.	8	$1\frac{2}{3}$	$7\frac{2}{3}$	$4\frac{1}{3}$	....	.	.....	....	..	1485
$\frac{1}{3}$	.	.	13	$\frac{1}{3}$	$7\frac{2}{3}$	$2\frac{2}{3}$	....	.	.....	....	..	1587
.	$11\frac{2}{3}$	.	6	.	.	.	....	.	.....	....	..	1488
.	.	.		.	.	.	....	.	.....	....	..	1487

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